

THE RECENT CRINOIDS OF THE COASTS OF AFRICA.

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HISTORY.

The history of the study of the recent crinoids inhabiting the coasts of Africa can be stated in a few words. With but three exceptions all the references to African crinoids are only incidental, incorporated in works sometimes restricted to the echinoderms alone, but more commonly very general in scope. Thus while the titles of books and papers number about seventy, from each one only a small amount of information is gained, and an adequate conception of African crinoids as a whole can be acquired only by an amount of labor totally incommensurate with the sum of the knowledge gained.

The first crinoid known from African waters was described from Mauritius in 1816 by Lamarck under the name of *Comatula carinata*. Lamarck adopted the name *carinata* from Leach, who in the previous year had diagnosed, in a very insufficient manner, his *Alecto carinata*, which Lamarck thought might turn out to be his species.

In 1817 the portion of Savigny's Description de l'Egypte dealing with the echinoderms was published, and in it were figured two comatulids from the Red Sea, one of which was designated by Audouin as "*Comatula* sp.," the other as "*Comatula multiradiata*." There is no further reference to the first of these figures, which represents *Tropiometra encrinus*; but in 1836 de Blainville copied the second in the atlas to his Manuel d'Actinologie. In doing this he made a curious mistake, for the plate is lettered "*Comatula adeonæ*," though in the text the description of *Comatula adeonæ* is taken from Lamarck, and the species is correctly said to have ten arms. In the following year the Penny Encyclopedia copied de Blainville's account of *Comatula adeonæ*, multiradiate figure and all, and the same slip was made by Knight in his Natural History, published in 1867.

Rüppel, in the course of his travels, found in the Red Sea an interesting multiradiate comatulid upon which he bestowed the manu-

script name of *Comatula leucomelas*, but I have not been able to find that he mentioned it anywhere in his works. In 1833 Leuckart came across his specimens in the Senckenberg Museum at Frankfort on Main and published the name, together with the locality, though without any diagnosis.

Leuckart was the first to describe the curious parasitic worms belonging to the genus *Myzostoma* with which crinoids are usually infested, his attention having been first called to them by mistaking one for a madreporic plate. In discussing the genus *Myzostoma* he mentions a multiradiate comatulid from the Red Sea, which, following Audouin, he identifies as *Comatula multiradiata*, but which von Graff, acting on the advice of P. H. Carpenter, has suggested was probably an example of *Heterometra savignii*, the species to which Audouin's *Comatula multiradiata* has always been referred.

In the *Iconographie du Regne Animal*, published by Guérin-Ménéville from 1828-1837, there are two figures¹ supposed to represent the species described as *Comatula carinata* from Mauritius. Possibly the first does represent this species, though it looks more like some species of *Antedon*; but the second (2a) appears to be a species of *Amphimetra*, and agrees fairly well with *A. discoidea* from northern Australia and the East Indies. There is a specimen of *Amphimetra discoidea* (labeled by P. H. Carpenter *Antedon milberti*, var. *dibrachinata*) in the Paris Museum from which I suspect the figure was drawn.

In 1841 Johannes Müller described his *Alecto savignii*, which was based upon specimens which had been brought from the Red Sea by Hemprich and Ehrenberg, now in the Berlin Museum, and he also identified Savigny's figure, which had been called *Comatula multiradiata* by Audouin, as this species. Two years later he described *Alecto wahlbergii* from specimens brought by Wahlberg from Port Natal, which he examined at the Stockholm Museum.

Michelin in 1845 noted the occurrence of *Comatula carinata* at Mauritius. His specimens are now in the Paris Museum.

In 1849 the comprehensive monograph of Müller, completing his studies on the comatulids, gave a summary of the knowledge in regard to African species at that date. Practically the same account was given in 1862 by Dujardin and Hupé in their monograph on the so-called Zoophytes.

Böhlische in 1866 described as new a curious little comatulid from the coast of Brazil which he had been unable to identify with any previously known species. He called it, in compliment to the justly famous Norwegian naturalist of that name, *Antedon dübenii*. This species has been the cause of considerable confusion. P. H.

¹ Zoophytes, pl. 1, figs. 2, 2a.

Carpenter identified with it a specimen which the *Challenger* dredged at Bahia, and figured both this specimen and the type in the *Challenger* report on the Comatulæ. The *Challenger* specimen is a young example of *Tropiometra picta*, but the type-specimen obviously belongs to the Antedonidæ and to the genus *Antedon*. Nothing like it has since been found on the American side of the Atlantic.

E. Von Martens in 1869 recorded from the Red Sea the *Alecto palmata* of Müller, which had originally been described from India, and at the same time recorded *Comatula solaris* from Zanzibar. The determination of the former was correct, but the latter appears to have been in reality *Tropiometra carinata*. Von Martens did not discover that the species recorded by Leuckart as *Comatula leucomelas* is the same as the one given by himself as *Comatula palmata*.

Sir C. Wyville Thomson, in his preliminary report upon the crinoids of the *Porcupine* expedition and in his semipopular work *The Depths of the Sea*, published in 1873, as well as in *The Atlantic*, published in 1877, touches upon the fauna of the Mediterranean, but the only crinoid he mentions from the vicinity of Africa is "*Rhizocrinus loffotensis*," which was dredged by the Swedish frigate *Josephine* on the Josephine Bank.

In 1878 Pourtalès and in 1879 Rathbun discussed at considerable length specimens of *Tropiometra carinata* from Zanzibar, comparing them with specimens of *T. picta* from the coast of Brazil.

In 1879 also Edgar A. Smith described in detail a new comatulid, *Comatula indica*, from the island of Rodriguez, which remains to-day the only crinoid known from that locality.

Greeff, while visiting the island of Rolas, in the Gulf of Guinea, found some crinoids there which he identified with the species inhabiting southern Europe. Carpenter was inclined to consider them as being in reality the *Antedon dübenii* of Böhlische, but it seems probable that they are identical with the *Antedon hupferi* of Hartlaub, which is closely related to that species.

De Loriol, discussing the echinoderms of Mauritius in 1883, includes, as did Michelin, *Tropiometra carinata*.

The work of the two French steamers, the *Travailleur* and the *Talisman*, had resulted in the discovery of many interesting crinoids off the coasts of southern Europe and northwestern Africa. Scattered references to these are found in the writings of E. Perrier, Captain Parfait, de Folin, and of the Marquis de Filhol, but they are mostly very indefinite and very unsatisfactory. Interest in these crinoids appears to have soon died out, and no detailed report upon them was ever prepared.

Prof. F. Jeffrey Bell, in listing the echinoderms obtained by the *Alert* in the western Indian Ocean, records (1884) immature specimens of a species of "*Actinometra*" from the Amirante Islands.

In the same year P. H. Carpenter published an account of the crinoids occurring between the Faroe Islands and Gibraltar, mostly based upon the results of the work of the *Porcupine* expedition, and he also finished the monograph on the stalked crinoids which had been obtained by the *Challenger*. This latter is more comprehensive in scope than is indicated by its title, for it includes an account of the material obtained by all the other exploring ships, in so far as he had access to it, and cites nearly all of the published references, thus offering a reasonably complete summary of everything known in regard to the recent stalked crinoids previous to 1884. Four years later this monograph was followed by a similar work dealing with the comatulids; but this is less comprehensive in its scope, so that species not among the *Challenger* collections are neither described in detail nor figured. As the *Challenger* obtained but a single species while in African waters, at Simons Bay, Natal, and that a well-known form (*Comanthus wahlbergii*), it is evident that African species receive a comparatively small amount of attention.

Hartlaub's monograph on the comatulid fauna of the East Indian Archipelago, published in 1891 (after a preliminary paper in 1890), fills many of the gaps left by Carpenter in the *Challenger* monograph. Two new African species, one from the Red Sea (*Antedon klunzingeri*) and the other from the Ivory coast (*Antedon hufferi*), are described as new and figured, and two others, known from the Red Sea since 1817 and 1833, are for the first time adequately figured.

Bell in 1892 described a new species of "*Antedon*" from Mauritius under the name of *A. emendatrix*. Ever since then it has been a great puzzle to determine what the species really is, as the diagnosis is far from clear, and there is a possibility that it covers two distinct species belonging to two different genera, one of which is a species of *Cenometra*, though Bell did not recognize its affinity with *C. bella*, which Hartlaub had made known two years previously.

In 1899 Hubert Ludwig published an important paper upon the echinoderms of Zanzibar, based upon a collection made in that country by Doctor Voeltzkow. In this he recapitulates the previous records for the region about Zanzibar published by von Martens, Rathbun, Pourtalès, and Carpenter, and adds *Antedon flagellata*, a species previously known only from Singapore and the Pelew Islands.

The work of the steamer *Valdivia* while under charter to the German Government resulted in the discovery of two interesting crinoids off the coast of Somaliland, which are figured by Professor Chun, with tentative identifications furnished by Professor Döderlein, in his interesting account of the voyage (*Aus den Tiefen des Weltmeeres*). One of these was a species of *Rhizocrinus*, a genus known from many places in the Atlantic, but hitherto only known outside that area from the indefinite report of Korotneff, who found a large species

(? *R. weberi*) in the Straits of Sunda; the other was a new species of *Pentametrocrinus*.

The work of the Prince of Monaco has added a great deal to our knowledge of the crinoids of the deeper waters off northwest Africa. Much information is contained in short papers published by the Prince himself and by Professors Kœhler and Richard. All the data acquired has recently (1909) been presented in magnificent form under the authorship of Professor Kœhler.

It is very remarkable that the *Princesse-Alice* should have obtained only two new species, but the lack of quantity is more than compensated by the interest attaching to one of them, *Gephyrocrinus grimaldii*, representing a second genus of Hyocrinidæ, first described in a preliminary paper by Professor Kœhler and Dr. F. A. Bather, jointly, in 1902.

The investigations conducted by the Cape of Good Hope Government into the marine resources of that colony had resulted in the accumulation of most excellent collections of echinoderms. These were turned over to Prof. F. Jeffrey Bell for determination, and he found among them four species of crinoids, three of which he described as new, assigning them all to systematic positions very remote from those they in reality occupy; his fourth species was misidentified. These four species are:

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| <i>Antedon capensis</i> | = <i>Tropiometra carinata</i> . |
| <i>Antedon sclateri</i> | = <i>Pachylometra sclateri</i> . |
| <i>Antedon magnicirra</i> | = <i>Crotalometra magnicirra</i> . |
| <i>Actinometra parvicirra</i> | = <i>Comanthus wahlbergii</i> . |

In his report upon the stalked crinoids of the *Siboga* expedition, which appeared toward the close of 1907, Professor Döderlein figured the species of *Rhizocrinus* dredged by the *Valdivia* off Somaliland, calling it, most appropriately, *Rhizocrinus chuni*.

Mr. Herbert C. Chadwick in 1908 communicated to the Linnæan Society of London a short paper upon the crinoids collected by Mr. Cyril Crossland on the coast of the Sudan during the course of the investigations of the marine biology of the Red Sea under the direction of Prof. W. A. Herdman. Six species are listed, four of which are new to the region; these are:

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| <i>Antedon serripinna</i> | = <i>Colobometra chadwicki</i> . |
| <i>Antedon parvicirra</i> | = <i>Iridometra ægyptica</i> . |
| <i>Antedon marginata</i> | = ? <i>Stephanometra marginata</i> . |
| <i>Antedon imparipinna</i> | = <i>Dichrometra protectus</i> . |
| <i>Antedon palmata</i> | = <i>Dichrometra palmata</i> . |
| <i>Antedon savignyi</i> | = <i>Heterometra savignii</i> . |

Mr. Chadwick himself was not certain of the correctness of his determination of *Antedon marginata*, and in a review I took the liberty of stating that *Antedon serripinna* and *A. parvicirra* were

possibly not quite the same as the East Indian species called by those names by Carpenter. Thanks to the kindness of Mr. Chadwick and Professor Herdman, I have been able to examine one of the specimens identified as *A. serripinna*, and I find it to be a new species of *Colobometra*, and not an *Oligometra* at all. I also found in the British Museum a specimen of what is undoubtedly his *Antedon parvicirra*, which turned out to be a new species of *Iridometra*.

In October 1909, Professor Bell reported upon the echinoderms of the Percy Sladen Trust expedition, which included four crinoids. All were misidentified. The four species are:

<i>Actinometra multiradiata</i>	= <i>Comatella maculata</i> .
<i>Antedon carinata</i>	= ? <i>Cosmiometra gardineri</i> .
<i>Antedon palmata</i>	= <i>Stephanometra indica</i> .
<i>Antedon spicata</i>	= <i>Cenometra emendatrix</i> .

MATERIAL.

The specimens examined in connection with the present work include all the crinoids from Africa in the British Museum, the Bergen Museum, the Museum of Comparative Zoölogy, the Copenhagen Museum, the Hamburg Museum, the Museum für Naturkunde and the Museum für Meereskunde, Berlin, the Oceanographic Museum at Monaco, the Paris Museum, and the U. S. National Museum. Among them are the originals of all the published records of Leuckart, Guérin-Ménéville, J. Müller, Michelin, Dujardin and Hupé, von Martens, Wyville Thomson, Pourtalès, Rathbun, E. A. Smith, Bell, P. H. Carpenter, Hartlaub, and Ludwig, and most of those of Döderlein and Chadwick. At Lyons Prof. R. Kœhler and M. Vaney showed me the specimens collected by the *Travailleur*, the *Talisman*, and the *Princesse-Alice*, upon which they are soon to publish a report. Two of their new species I had already seen in the museums at London and Paris, and I had drawn up diagnoses of them; but it is only fair to those gentlemen to withhold my diagnoses until they are able to publish theirs, and to confine myself, in treating of the material collected by the French and Monacan ships, to the published records.

FAUNAL RELATIONSHIPS OF THE AFRICAN COASTS.

There are known to-day from the coasts of Africa and the outlying islands fifty-three species of recent crinoids; forty-five of these belong to the Comatulida, representing seven families, viz, the Comasteridæ (six); the Himerometridæ (twelve); the Colobometridæ (six); the Tropiometridæ (three); the Thalassometridæ (eight); the Antedonidæ (eight), and the Pentametrocrinidæ (two), while eight are stalked, representing the Pentacrinidæ (one); the Hyocrinidæ (one), and the Rhizocrinidæ (six). These species are included in twenty-four genera, of which four are stalked.

The African shores are faunally divisible into five well-marked districts, each with its characteristic species and genera, as follows:

MEDITERRANEAN COAST.

Family ANTEDONIDÆ.

Antedon mediterranea.

Leptometra phalangium.

NORTHWEST COAST (STRAITS OF GIBRALTAR TO CAPE VERDE, INCLUDING THE AZORES, MADEIRA, CANARY, AND CAPE VERDE ISLANDS).

Family COMASTERIDÆ.

Neocomatella (new species).¹

Family THALASSOMETRIDÆ.

Crotalometra flava.¹

Thalassometra lusitanica.¹

Thalassometra omissa.¹

Family ANTEDONIDÆ.

Antedon bifida.

Leptometra cellica.

Family PENTAMETROCRINIDÆ.

Pentametrocrinus atlanticus.^{2 1}

Family PENTACRINITIDÆ.

Endoxocrinus wyvillethomsoni.¹

Family HYOCRINIDÆ.

Gephyrocrinus grimaldii.¹

Family BOURGUETICRINIDÆ.

Bathycrinus gracilis.¹

Bathycrinus recuperatus.¹

Bathycrinus perrieri.¹

Rhizocrinus parfaiti.^{2 1}

WEST COAST (INCLUDING THE ISLANDS OF ST. HELENA AND ASCENSION).

Family TROPIOMETRIDÆ.

Tropiometra pieta.²

Family ANTEDONIDÆ.

Antedon hupferi.

¹ Deep-water species.

² Occurs also in the West Indies.

Family THALASSOMETRIDÆ.

Crotalometra porrecta.¹*Thalassometra multispina*.¹

Family RHIZOCRINIDÆ.

Bathycrinus aldrichianus.¹

SOUTHEAST COAST (FROM MOMBASA TO CAPE TOWN, INCLUDING ALL THE OUTLYING ISLANDS).

Family COMASTERIDÆ.

Comatella maculata.*Capillaster multiradiata*.*Comissia ignota*.*Comanthus parvicirra*.*Comanthus wahlbergii*.

Family HIMEROMETRIDÆ.

Amphimetra africana.*Craspedometra madagascarensis*.*Heterometra joubini*.*Heterometra gravieri*.*Stephanometra indica*.*Dichrometra flagellata*.

Family COLOBOMETRIDÆ.

Cenometra emendatrix.*Decametra möbiusi*.*Decametra modica*.*Decametra alaudæ*.*Oligometra scrippinna*.

Family TROPIOMETRIDÆ.

Tropiometra carinata.

Family THALASSOMETRIDÆ.

Crotalometra magnicirra.¹*Cosmiometra gardineri*.¹*Pachylometra sclateri*.¹

Family ANTEDONIDÆ.

Iridometra mauritiana.*Perometra afra*.

NORTHEAST COAST (FROM BRITISH EAST AFRICA TO SUEZ).

Family COMASTERIDÆ.

Comanthus (?*parvicirra*).¹ Deep-water species.

Family HIMEROMETRIDÆ.

<i>Craspedometra ater.</i>	<i>Dichrometra protectus.</i>
<i>Heterometra savignii.</i>	<i>Dichrometra klunzingeri.</i>
<i>Stephanometra marginata.</i>	<i>Dichrometra palmata.</i>

Family COLOBOMETRIDÆ.

Colobometra chadwicki.

Family TROPIOMETRIDÆ.

Tropiometra encrinus.

Family ANTEDONIDÆ.

Iridometra ægyptica.

Family PENTAMETROCRINIDÆ.

Pentametrocrinus (new species).¹

Family RHIZOCRINIDÆ.

*Rhizocrinus chuni.*¹

Mediterranean coast.—So far as we know, the Mediterranean coast of Africa is the same faunally as the Mediterranean coast of Europe. Only two genera, *Antedon* and *Leptometra*, are found here, both of which are primarily, as I have shown, of Indian Ocean or East Indian origin,² and both of which occur in the Atlantic northward nearly or quite to Norway. These two genera may be said to delimit the EUROPEAN faunal area—in reality an attenuated derivative from the great Indo-Pacific-Japanese region—and this EUROPEAN faunal area may logically be divided into (1) the *Mediterranean* area, inhabited by *Antedon mediterranea*, *A. adriatica*, and *Leptometra phalangium*; and (2) the *European-Atlantic* area, inhabited by *Antedon petasus*, *A. bifida*, and *Leptometra celtica*, and extending from Norway south to Morocco and Madeira.

Northwest coast.—This is the meeting ground between the preceding and succeeding littoral faunal areas; here the *European-Atlantic* area reaches its southern and the *West African* its northern limit.

In the deeper water, however, inhabited by species of the *Intermediate* faunal zone,³ we find a strongly marked "West Indian" element, indicated by *Neocomatella*, *Pentametrocrinus atlanticus*, and *Rhizocrinus parfaii*.

¹ Deep-water species.

² Cf. Vid. Medd. fra den naturhist. Forening i København, 1909, p. 128 et seq.

³ Idem., p. 126.

Thanks to the work of the ships of the U. S. Coast Survey and the U. S. Fish Commission we have long had data upon which to base a concept of the Antillean crinoid fauna, and we are able to state with a reasonable degree of accuracy that this fauna is directly derived from, and forms the outer fringe of, the great *Intermediate* area, the maximum intensity of which lies within a triangle whose apices are, roughly, southern Japan, the Kermadec Islands, and Singapore. Just as the genera *Antedon* and *Leptometra* characterizing the European faunal area are distinct from, though very closely related to, the parent genera *Mastigometra* and *Psathyrometra* of the East Indies, so the genera found in the West Indies are very closely related to, but entirely distinct from, the corresponding East Indian genera. The correspondence is well brought out by the following list:

WEST INDIAN GENUS.

CORRESPONDING EAST INDIAN GENUS.

Family COMASTERIDÆ.

<i>Nemaster.</i>	<i>Capillaster.</i>
<i>Neocomatella.</i>	<i>Comatella.</i>
<i>Leptonemaster.</i>	<i>Comissia.</i>
<i>Comactinia.</i>	<i>Comatula.</i>

Family HIMEROMETRIDÆ.

<i>Analeidometra.</i>	<i>Stephanometra.</i>
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Family THALASSOMETRIDÆ.

<i>Stylometra.</i>	<i>Cosmiometra.</i>
<i>Crinometra.</i>	{ <i>Pachylometra.</i>
	{ <i>Glyptometra.</i>

Family ANTEDONIDÆ.

<i>Hypalometra.</i>	<i>Erythrometra.</i>
<i>Zenometra.</i>	<i>Psathyrometra.</i>
<i>Coccometra.</i>	<i>Thysanometra.</i>

Certain other genera probably should be paired in the same way, but our data in regard to them is as yet insufficient for generalization; a number of genera are, of course, common to both regions, though the species are never the same.

Now the entire western coast of North and South America is, as I have shown,¹ purely *Antarctic*, or, more precisely, *Magellanic*, in its affinities; the Indo-Pacific-Japanese species disappear far to the westward among the South Sea islands. It is thus highly improbable that the West Indies could ever have become colonized from the westward; if such had been the case there would certainly be traces

¹Geographical Journal, vol. 32, No. 6, p. 602 et seq.

remaining of the zoögeographic progression on the tropical west American coast. Moreover, the geology of the country between North and South America shows that there has been a fairly permanent land barrier at all times between the Caribbean and the Pacific; such channels as have intercommunicated between them could never have been deep, as none of the characteristic animals occurring below the sublittoral zone on the Pacific side appear to have passed through to the Caribbean. No crinoids ever passed through in either direction, and there is not even a subfamily or a genus common to both coasts of Central America; but crinoids are almost entirely sessile—much more nearly so than any other marine organisms—and many barriers therefore operate against their dispersal which are ineffective against other animals, including the other echinoderms.¹

The crinoids, therefore, move very slowly into new territory for this reason and also because of their slight adaptability to changes of salinity and especially of temperature, and the fact that a few of the littoral echinoids, ophiuroids, and asteroids have, during the periods when communication was established between the Caribbean and the Pacific, made their way from the former into the latter, does not in any way disprove the hypothesis that there has at all times been an insuperable barrier to the dispersal of the crinoids.

Thus it seems necessary to assume that the West Indian crinoid fauna reached the Caribbean basin from the eastward, from the northwest coast of Africa, having previously reached that district from the southward or southeastward, not from the eastward or northeastward.

According to this, the northwest African intermediate fauna (including that of Europe south of the Bay of Biscay) is zoögeographically more important than the West Indian, though at present much less known; the two, so far as can be judged, are practically the same, so that together they may be considered as making up a *South European-Northwest African-Antillean* faunal division of the intermediate region, which falls naturally into two subdivisions, (1) an *Afro-European* and (2) an *Antillean*.

It is a very curious fact that almost without a single exception the genera and species of this faunal division inhabit deeper—often much deeper—water than the genera and species from which they have been derived in the East Indian seas, and their habitat in the east is deeper again than their habitat in the west. It would appear that this faunal division has taken from the great parent Indo-Pacific-Japanese region only such genera as are most plastic and can best adapt themselves to changing conditions; these genera have been able to survive, but have become differentiated from the parent stock, while all the other less plastic genera, which we must assume were

¹ Vid. Medd. fra den naturhist. Forening i Kjøbenhavn, 1909, pp. 117-133.

originally carried along with them, have died out. The difference in depth of habitat between the species on the opposite coasts of the Atlantic is probably due to a difference in the nature of the food supply, and the increased depth of the habitat of the West Indian genera over their East Indian relatives originated probably from the same cause.¹

There is, therefore, a close similarity in origin between the species of the *European* and the south *European-northwest African-Antillean* faunal divisions; the former have reached their present habitat by passing northwestward around or across the northern end of what is now Africa, the latter by passing more to the southward. At first similar extensions from the common parent region, the diverse conditions which in past geologic ages they encountered, one in the north and the other in the south, reduced them differently, so that now they present a totally different aspect, and one would never suspect a common origin were they not both equally closely related to the parent region.

It is very interesting that in the ages since the constituent elements of these two faunal divisions left the parent region only comparatively slight changes have occurred; no widely diverse generic types have been evolved, and none of the collateral parent genera have entirely died out behind them, though they have largely disappeared from the intervening seas of the present day, being preserved, however, in certain cases, as fossils in the later rocks.

West coast.—There are only two littoral comatulids known from the west African coast and the outlying islands; one of these (*Tropiometra picta*) is, so far as I can see, identical with the commonest species on the opposite coast of South America, while the other (*Antedon hupferi*) is very close to a corresponding species originally described from Rio de Janeiro and since reported from Abrolhos and Madeira (*Antedon diibenii*). The third littoral Brazilian comatulid (*Nemaster lineata*) has probably spread southward from the West Indies just as *Tropiometra picta* has worked its way northward to those islands.

The faunal division characterized by the presence of *Tropiometra picta* and the small short armed species of *Antedon* may be conveniently known as the *West African-South American* area.

In the deep waters of the Atlantic there occur certain genera of the Oceanic region which are found in all deep seas, except that they never intrude upon the territory occupied by the so-called *Polar-Pacific* species. Such genera are *Bathyrinus*, *Bathymetra*, *Crotalometra*, and *Thalassometra*; possibly *Gephyrocrinus* should also be placed here.

¹ Geographical Journal, vol. 32, No. 6, p. 602 et seq.

Southeast coast.—The southeastern coast of Africa is faunally the richest section of the continent, supporting twenty-two species distributed among eighteen genera, of which latter eleven do not occur farther north. All of the genera are widely spread throughout the Indo-Pacific-Japanese region, but sixteen of the twenty-two species are confined to southeastern Africa, only six occurring in Ceylon and eastward. The only four species of the deeper water yet known belong to characteristically East Indian genera.

The affinities of this district are obviously with Ceylon and the region to the eastward of that island rather than with the coasts of the Arabian Sea, and the modern crinoid fauna evidently worked southwestward along the line now indicated by the Maldives, Chagos, and Cargados islands to what is now Mauritius, Madagascar, and southeast Africa.

The following genera are common to southeast Africa and Ceylon (or the Bay of Bengal), but do not occur on the shores of the Arabian Sea north of Ceylon or north of British East Africa:

<i>Comatella.</i>	<i>Decametra.</i>
<i>Capillaster.</i>	<i>Oligometra.</i>
<i>Comissia.</i>	<i>Crotalometra.</i>
<i>Bennettia</i> group of <i>Comanthus.</i>	<i>Cosmiometra.</i>
<i>Amphimetra.</i>	<i>Pachylometra.</i>
<i>Cenometra.</i>	<i>Perometra.</i>

The same is, so far as we know, true of the following species:

<i>Comatella maculata.</i>	<i>Stephanometra indica.</i>
<i>Capillaster multiradiata.</i>	<i>Dichrometra flagellata.</i>
<i>Oligometra serripinna.</i>	

As the south *European-northwest African-Antillean* division offers some striking points of similarity to the attenuated western extremity of the Indo-Pacific-Japanese region, as seen in southeast Africa, we are justified in supposing that it was originally derived from it by passage across what is now central Africa; in other words, that the genera characterizing it have moved outward from the East Indian region, first southwestward to southeast Africa and then northeastward to their present habitat.

The area from Mombasa southward to Cape Colony, and including Madagascar, the Seychelles, Réunion, and Mauritius, and the other islands as far as the Chagos group may be conveniently known as the *Southeast African* faunal division of the Indo-Pacific-Japanese region.

Along the coasts of Cape Colony and Natal occurs a comasterid (*Comanthus wahlbergii*) found nowhere else, but closely related to *Comanthus trichoptera* of southern Australia. Although it is associated with tropical forms, and although there are no representatives there of the other south Australian species, we must recognize the fact that the *Cape* subdivision is not quite the same faunally as the

shores farther north; it is poorer in species, and is modified by the intrusion of a south Australian element, just as has been shown in the case of many other animals.

Northeast coast.—The northeast coast of Africa is singularly different in the aspect of its crinoid fauna from the coast to the southward. Of strictly comparable species there are only ten, distributed among eight genera, of which one is not known from farther south; this is:

Colobometra.

All of the genera are purely East Indian; of the species five extend to India or beyond; these are:

Heterometra savignii.

Dichrometra protectus.

Stephanometra marginata.

Dichrometra palmata.

Tropiometra encrinurus.

The fauna of northeast Africa therefore is purely a derivative from East Indian stock, just as that of southeast Africa is, but a curious segregation of the genera and species composing the *Indo-Pacific-Japanese* region has occurred, one set of forms following the coasts of the Arabian Sea, the other extending in a southeasterly direction toward the Cape. While the faunas of the northeast and of the southeast coasts differ considerably between themselves, they are both about equally related to the general East Indian fauna, and the component species of both are remarkable in being in general smaller than the corresponding species in the great parent area.

The shores from Somaliland northward to and including the Red Sea, and thence eastward to the Persian Gulf, may be considered as marking the *Northeast African* faunal division.

Whether or not the genera *Antedon* and *Leptometra* reached their present habitat by way of the Arabian Sea—that is, through the fauna now occupying the shores of that basin—it is not possible to say; *Mastigometra* and *Psathyrometra*, their eastern equivalents, occur at or near Ceylon, but are known no farther west. They may have gone “overland” from India; may have passed along the shores of the Arabian Sea (or its ancient homologue) and subsequently died out, or, which is much the most likely, they may yet remain to be discovered between Ceylon and Suez.

Summary.—The crinoid fauna of the coasts of Africa falls into five divisions, as follows:

1. The **EUROPEAN** division, including the Mediterranean coast, and the northwest coast north of Morocco and Madeira; this falls into two subdivisions:

(a) The *Mediterranean* subdivision, comprising the coast of the Mediterranean, and

(b) The *European-Atlantic* subdivision, extending on the Atlantic coast from Madeira and Morocco northward;

2. The SOUTH EUROPEAN-NORTHWEST AFRICAN-ANTILLEAN division, extending from Madeira and Morocco northward to the Bay of Biscay and westward to and including the Caribbean Sea;

3. The WEST AFRICAN SOUTH-AMERICAN division, including the coast south of Morocco and the opposite coast of Brazil, with the intervening islands;

4. The SOUTHEAST AFRICAN division, extending from Mombasa to Cape Town, and eastward to include Madagascar, the Seychelles, Réunion, and Mauritius, and the intervening islands eastward to the Chagos archipelago; the southern part of this division, comprising the coasts of Cape Colony and Natal, forms the *Cape* subdivision; and

5. The NORTHEAST AFRICAN division, extending from Somaliland northward throughout the Red Sea and eastward to the Persian Gulf.

The West African-South American division is an attenuated offshoot from the South European-Northwest African-Antillean division, which itself is derived from the Southeast African division, the last the somewhat modified southwestern extremity of the great Indo-Pacific-Japanese faunal area.

The European faunal division is probably an attenuated offshoot from the Northeast African division, which itself is the considerably modified northwestern extremity of the great Indo-Pacific-Japanese faunal area.

ANNOTATED LIST OF SPECIES.

I. COMATULIDS.

Suborder OLIGOPHREATA.

Family COMASTERIDÆ.

Subfamily CAPILLASTERINÆ.

Genus NEOCOMATELLA A. H. Clark.

NEOCOMATELLA (new species).

Actinometra pulchella (part) P. H. CARPENTER, Proc. Roy. Soc. Edinburgh, vol. 12, 1884, p. 369; *Challenger* Reports, vol. 26, Zoology, 1888, p. 304—KEHLER and VANEY, Bull. du mus. d'hist. nat., 1910, No. 1, p. 32.

Localities.—West of Gibraltar (lat. $35^{\circ} 56' N.$; long. $7^{\circ} 06' W.$); northeast of the Seine Bank (lat. $34^{\circ} 57' N.$; long. $11^{\circ} 57' W.$); off Cape Peñas; south of Cape St. Vincent (lat. $35^{\circ} 26' N.$; long. $9^{\circ} 09' W.$); south of the Canary Islands (lat. $25^{\circ} 41' N.$; long. $18^{\circ} 16' W.$).

Depth.—228–533 fathoms.

Bottom temperature.— 50.5° Fahr. (one record).

Bottom.—Clay (one record).¹

¹*Comatula solaris* has been recorded from the east coast of Africa (Zanzibar) by Professor von Martens, but the record appears to have been based upon a specimen of *Tropiometra carinata*.

Genus COMATELLA A. H. Clark.

COMATELLA MACULATA (P. H. Carpenter).

Actinometra multiradiata BELL, Trans. Linn. Soc. (Zool.), (2), vol. 13, 1909, pt. 1, p. 20.

Localities.—Salomon, from the reef; Coin Peros.

Remarks.—The specimen from Salomon, which I examined at the British Museum, has twenty-six arms 85 mm. long; the cirri are XXI, 15–18. The IIIBr series are all developed externally. Compared directly with the type of Carpenter's *maculata*, this specimen is found to differ only in having more numerous arms.

Genus CAPILLASTER A. H. Clark.

CAPILLASTER MULTIRADIATA (Linnæus).

Asterias pectinata (part) LINNÆUS, Syst. Nat., 10th ed., 1758, p. 663 (reference to Petiver).

Asterias multiradiata LINNÆUS, Syst. Nat., 10th ed., 1758, p. 663 (type-specimen at Lund, but not references cited).

Comatula fimbriata LAMARCK, Hist. nat. des animaux sans vertèbres, vol. 2, 1816, p. 535.

Comatula coccodistoma (Paris Museum MS.) DUJARDIN and HUPÉ, Hist. nat. des zoophytes; échinodermes, 1862, p. 208.

Actinometra coppingeri BELL, Proc. Zool. Soc. London, 1882, p. 535.—Rep. Zool. Coll. H. M. S. *Alert*, 1884, p. 168, pl. 16, fig. B.

Actinometra multiradiata P. H. CARPENTER, *Challenger* Reports, vol. 26, 1888, Zoology, p. 322, pl. 66, figs. 1–3.

Capillaster multiradiata A. H. CLARK, Vid. Medd. fra den naturhist. Forening i København, 1909, p. 134.

Localities.—Madagascar; Cape St. André, Madagascar.

Depth.—Littoral, and down to about 30 meters.

In the Paris Museum there are three specimens of this species from Madagascar; one has the cirri XV, 21–23, and nineteen arms, one IIIBr series being lacking; two of the IIIBr series are 2, the remaining seven being 4 (3+4); another (Cape St. André; about 30 meters) has the cirri XVIII, 21–22, and twelve arms, one ray bearing two IIIBr 4 (3+4) series; the brachials are very short and overlap rather strongly; the third is like the first, and also has nineteen arms; no IIIBr series are present.

Compared directly with a typical example from the Straits of Sunda, these three specimens are seen to be smaller and proportionately weaker, but otherwise I can find no differences whatever. IIIBr series, very common among East Indian specimens, do not occur. Very possibly these specimens represent a local permanently small race confined to the southeast African region. If this should prove to be the case the name *coccodistoma* would be applicable to it.

Genus COMISSIA A. H. Clark.

COMISSIA IGNOTA, new species.

Actinometra BELL, Rep. Zool. Coll. H. M. S. *Alert*, 1884, p. 510.

Actinometra pectinata Brit. Mus. MS.

Description.—Centrodorsal discoidal, with a flat dorsal pole 1.5 mm.—2 mm. in diameter.

Cirri XII–XV, 9–11 (usually 10–11), 4 mm.—5 mm. long; first segment short, second not quite so long as broad, the following increasing in length to the fourth, which is about three times as long as the median diameter; the sixth and following are about as long as broad; the third and fourth are strongly “dice-box shaped;” the fifth and following each bear a minute sharp subterminal tubercle; the shorter distal segments are somewhat compressed laterally, and hence appear comparatively broad in lateral view; the opposing spine is slight and inconspicuous.

Radials concealed; IBr_1 well separated, the interrarial angle of separation being about 90° .

Ten arms 30 mm.—35 mm. long, resembling in general those of *Leptonemaster venustus*, but proportionately slightly stouter; genital glands are developed on the pinnules.

Locality.—Marie Louise Island, and Isle des Neufs, Amirante group; collected by H. M. S. *Alert*.

Depth.—17 fathoms.

Bottom.—Coral.

Subfamily COMASTERINÆ.

Genus COMANTHUS A. H. Clark.

Subgenus COMANTHUS.

Specific group BENNETTIA.

COMANTHUS (BENNETTIA) WAHLBERGII (J. Müller).

Comatula coccodistoma (part) Paris Museum MS.

Alecto wahlbergii J. MÜLLER, Archiv für Naturgesch., 1843, Heft 1, p. 131.

Actinometra parvicirra (part) P. H. CARPENTER, *Challenger Reports*, vol. 26, Zoology, 1888, p. 338.—BELL, *Marine Investigations in South Africa*, vol. 4, pt. 4, p. 141.

Localities.—Port Natal; Simons Bay, Natal; False Bay; Cape of Good Hope; Algoa Bay, close to Riy Bank (lat. $33^\circ 58' S.$; long. $25^\circ 51' 30'' E.$); Tugela River mouth bearing NW. by W., $3\frac{1}{2}$ miles distant.

Depth.—Littoral, and down to 25 fathoms.

Bottom.—Dark sand, black specks, and rocks; rocks.

Remarks.—Hitherto this species has always been confused with the common East Indian *Comanthus parvicirra*, from which, however, it is very sharply separated, not even belonging in the same specific group. Its closest affinity is with *Comanthus trichoptera* of southern

Australia, and its presence at the Cape indicates a connection between the crinoid faunas of these two localities similar to that shown in many other groups.

Comanthus wahlbergii is a small stout species with well-developed, permanent cirri; these are from XII-XXV, 13-17 (usually about XV, 16), about 10 mm. long; from the fifth to the seventh (usually the sixth) a transition segment is developed which is usually well marked.

The centrodorsal is thin discoidal, with a broad flat dorsal pole 4 mm. in diameter, resembling that of *C. trichoptera*.

The arms are from thirteen to twenty-one in number (usually from sixteen to twenty) and are commonly about 60 mm. long. IIIBr series are rare. All the division series are 4 (3 + 4). The arms are short and stout, tapering rapidly, much as in *Comatula brachiolata*. The brachials overlap conspicuously, and the ends of the elements of the division series are prominent. The division series are broad and are close together laterally.

One of the specimens which I examined in the British Museum (catalogued under the name of *Actinometra paucicirra*) has thirteen pentacrinoids attached to the cirri; these are similar to those of *Comactinia meridionalis* and possess seventeen columnars.

Specific group VALIDIA.

COMANTHUS (VALIDIA) PARVICIRRA (J. Müller).

- Alecto parvicirra* J. MÜLLER, Archiv für Naturgesch., 1841, Heft 1, p. 145.
Alecto timorensis J. MÜLLER, Archiv für Naturgesch., 1841, Heft 1, p. 145.
Comatula brevicirra DUJARDIN and HUPÉ, Hist. nat. des zoophytes; échinodermes, 1862, p. 208.
Comatula simplex DUJARDIN and HUPÉ, Hist. nat. des zoophytes; échinodermes, 1862, p. 208.
Actinometra trachygaster (part) LÜTKEN, Mus. Godeffr. Cat., vol. 4, 1869, p. 125.
Actinometra intricata (part) LÜTKEN, Mus. Godeffr. Cat., vol. 5, 1874, p. 190.
Comatula mertensi GRUBE, J. B. der schls. Gesellsch. für vaterl. Cultur, 1875, p. 74.
Actinometra armata W. B. CARPENTER, Proc. Roy. Soc. London, vol. 24, 1876, p. 451.
Actinometra polymorpha P. H. CARPENTER, Journ. Linn. Soc. (Zool.), vol. 13, 1877, p. 440.
Actinometra meyeri P. H. CARPENTER, Journ. Linn. Soc. (Zool.), vol. 16, 1882, p. 525.
Antedon mertensi BELL, Proc. Zool. Soc. London, 1882, p. 535.
Actinometra mutabilis VON GRAFF, Challenger Reports, vol. 10, Zoology, 1884, p. 13.
Actinometra annotea BELL, Sci. Trans. Roy. Dublin Soc. (2), vol. 3, 1887, p. 645.
Actinometra elongata P. H. CARPENTER, Challenger Reports, vol. 26, Zoology, 1888, p. 311.
Actinometra simplex P. H. CARPENTER, Challenger Reports, vol. 26, Zoology, 1888, p. 312.
Actinometra quadrata P. H. CARPENTER, Challenger Reports, vol. 26, Zoology, 1888, p. 331.

Actinometra parvicirra (part) P. H. CARPENTER, *Challenger Reports*, vol. 26, Zoology, 1888, p. 338.

Actinometra rotalaria P. H. CARPENTER, *Challenger Reports*, vol. 26, Zoology, 1888, p. 313.

Actinometra guttata (LÜTKEN MS.) HARTLAUB, *Nova Acta Acad. German.*, vol. 58, No. 1, 1891, p. 96.

Comatula orientalis A. H. CLARK, *Proc. U. S. Nat. Mus.*, vol. 33, 1907, p. 155.

Comatula helianthus A. H. CLARK, *Proc. U. S. Nat. Mus.*, vol. 34, 1908, p. 440.

Comanthus rotalaria A. H. CLARK, *Smiths. Misc. Coll. (Quarterly Issue)*, vol. 52, pt. 2, 1908, p. 205.

Comanthus (Comanthus) rotalaria A. H. CLARK, *Vid. Medd. fra den naturhist. Forening i København*, 1909, p. 144.

Locality.—Seychelles; two specimens in the British Museum were collected by the *Sea Lark* expedition, under Prof. J. Stanley Gardiner.

Depth.—34 fathoms.

Remarks.—In the Berlin Museum there are some immature comasterids from the Seychelles and some others from the Red Sea, the latter collected by Dr. R. Hartmeyer, which may belong to this species.

According to the data given by Carpenter in the *Challenger* report, the first available name for this species is *Comatula rotalaria* of Lamarck, Carpenter's figure of *Actinometra rotalaria* clearly representing this species. Upon examining Lamarck's types at the Paris Museum, however, I found that his *rotalaria* is the species called *Actinometra jukesii* by Carpenter and *Actinometra paucicirra* by Bell, so that Müller's *parvicirra* becomes the earliest available name for the present form.

Müller's *Alecto wahlbergii* must be eliminated from the synonymy of *Comanthus parvicirra*, in which it was included by Carpenter, as it has proved to be quite a different thing, a species related to *C. trichoptera* of southern Australia and not to *C. parvicirra* at all.

COMANTHUS (1 species).

Locality.—Cape St. André, Madagascar.

Depth.—About 30 meters.

Remarks.—Dr. P. R. Joly dredged in 1901 a single small specimen, undergoing adolescent autotomy, of some species of *Comanthus*. The cirri are XIII, 13-14; there are twenty-three arms; one of the internal IIBr series is 2, all the other division series being 4 (3+4). The rays bear 4 (3+1), 5 (1+4), 5 (4+1), 2, and 7 (4+3) arms respectively. The cirri are rather more developed than is usual in *C. parvicirra*, with which the specimen otherwise agrees fairly well, and are rather more compressed and curved distally. The interradi al perisome is strongly plated.

COMANTHUS (? species).

Actinometra cumingii Brit. Mus. MS.

Locality.—Mauritius.

Remarks.—There are two small comasterids in the British Museum from Mauritius, one with thirteen, the other with fourteen arms, which are very close to, if not the same thing as, *Comanthus parvicirra*.

Family HIMEROMETRIDÆ.

Subfamily HIMEROMETRINÆ.

Genus AMPHIMETRA A. H. Clark.

AMPHIMETRA AFRICANA, new species.

Description.—Centrodorsal, thin-discoidal, broad, the flat polar area being 4 mm. in diameter; cirrus sockets in a single more or less irregular closely crowded marginal row.

Cirri XXIII, 29–32 (usually 30), 20 mm. to 23 mm. long; first segment short, the following gradually increasing in length to the seventh or eighth, which is about as long as broad; following similar, after the eleventh or twelfth very gradually decreasing in length so that the terminal segments are about one-third broader than long; tenth or eleventh (usually the latter) and following bearing long and prominent dorsal spines which begin abruptly; the cirri do not taper distally.

Radials entirely concealed; IBr_1 very short, bandlike, in apposition laterally; IBr_2 short, two and one-half times as broad as long, the lateral edges not so long as those of the IBr_1 , in apposition; $IIBr_4$ (3+4) (eight $IIBr$ series are present; the other arms are broken off before the first syzygy); IBr , $IIBr$, and first brachials in close lateral apposition and sharply flattened against each other; sides of IBr and $IIBr$ series slightly produced; synarthrial tubercles obsolete.

Nineteen (? twenty) arms (in the type) apparently about 125 mm. long; first brachial short, slightly wedge shaped, twice as broad as long exteriorly, interiorly united; second brachial slightly larger and more obliquely wedge shaped; third and fourth (syzygial pair) slightly longer interiorly than exteriorly, twice as broad as long interiorly; following four or five brachials oblong, three times as broad as long, then becoming obliquely wedge shaped, twice as broad as long, and gradually less obliquely wedge shaped, after the end of the proximal half of the arm being practically oblong and very short.

P_1 12.5 mm. long, slender, flagellate distally, with twenty-nine segments, at first twice as broad as long, becoming about as long as broad on the eighth and nearly twice as long as broad terminally; second and following segments with a sharp carinate ridge with the crest parallel to the axis of the pinnule, which gradually becomes less

marked, disappearing on the tenth segment; P_2 15 mm. long, considerably stouter than P_1 and not tapering so rapidly distally, with twenty-five segments, at first short, becoming about as long as broad on the eighth or tenth, and twice as long as broad terminally; from the fourth segment there runs outward on the outer side of the pinnule just distal to the medio-dorsal line a prominent narrow ridge which continues almost to the tip; there is a similar but less marked ridge on P_1 ; second and following segments rather sharply, but not highly, carinate; P_3 similar to P_2 , slightly longer, about the same size, or slightly shorter and smaller; P_4 7 mm. long, rather stout, though much smaller than P_3 , tapering evenly to the tip, with fifteen segments which become about as long as broad on the eighth; the second-eighth are rather strongly carinate; P_5 similar, but more slender, 6 mm. long, with only the second-sixth segments carinate; the following pinnules gradually lose the basal carination, become more slender, and increase in length, reaching 8 mm. distally.

The color is brownish purple.

Localities.—Bagamoyo, German East Africa; the type is No. 4616, Berlin Museum.

Zanzibar; a smaller specimen in the British Museum has the cirri XVI, 25–27, but is otherwise similar.

Waxin; I also found in the British Museum a specimen (labeled "*Actinometra* sp.") from Waxin, south of Mombasa. This specimen has twenty-three arms 120 mm. long, the IIBr series being 4 (3+4) and the IIIBr series being 2; the cirri are XX, 27; long, sharp dorsal spines are developed from the tenth segment onward. Compared directly with a specimen of *H. savignii* the cirri are seen to be more spiny, the spines commencing nearer the centrodorsal, and the proximal pinnules are seen to be larger.

Remarks.—This species comes nearest to *Amphimetra philiberti* from the East Indies, but it is a smaller and less rugged form with fewer arms and much more spiny cirri.

Genus CRASPEDOMETRA A. H. Clark.

CRASPEDOMETRA ATER, new species.

Antedon ludovici Berlin Mus. MS.

Description.—Centrodorsal thick discoidal, the bare polar area slightly convex, 4 mm. in diameter; cirrus sockets in one and a partial second crowded and irregular marginal row.

Cirri XXII, 32–36, 30 mm. to 33 mm. long, stout, not tapering distally; first segment short, the following gradually increasing in length to the fifth or sixth, which, with the remainder, is about half again as broad as long; on the fifteenth or sixteenth the middle of the distal dorsal edge becomes prominent, this after one or two more segments becoming a prominent rather high rounded carination of the entire

median dorsal line; distally this carination gradually narrows antero-posteriorly so that on the last four or five segments preceding the penultimate there is only a blunt median spine; opposing spine usually rather longer and sharper than the spines on the preceding segments, terminal or subterminal, directed obliquely forward, half as long as the lateral diameter of the penultimate segment; terminal claw somewhat longer than the penultimate segment, stout and strongly curved basally but becoming straighter and more slender in the distal two-thirds.

Radials almost entirely concealed in the median line, but visible as a very low broad triangle in the angles of the calyx; IBr_1 very short, bandlike, five or six times as broad as long, in close apposition laterally; IBr_2 very broadly pentagonal, twice as broad as long; $IIBr$ 4 (3 + 4), well rounded dorsally; ossicles of the IBr and $IIBr$ series as far as P_D in lateral apposition, though not especially flattened; synarthrial tubercles obsolete.

Fourteen arms (in the type) about 160 mm. long; first brachial very short, slightly wedge shaped, almost entirely united interiorly; second brachial larger, more obliquely wedge shaped; third and fourth (syzygial pair) oblong, two and one-half to three times as broad as long; following five or six brachials oblong, three to four times as broad as long, then becoming wedge shaped, moderately oblique, about three times as broad as long, soon gradually becoming less and less oblique, in the outer part of the arm being very short, three or three and a half times as broad as long, only slightly wedge shaped.

P_D 11 mm. long with thirty-three segments, moderately stout proximally but rapidly tapering and becoming very slender and flagellate in the distal half; segments at first nearly three times as broad as long, but gradually increasing in length and becoming nearly or quite as long as broad in the distal third; P_1 13 mm. long with twenty-six segments, considerably stouter than P_D and tapering much less rapidly; the second-eighth segments are strongly carinate; P_2 22 mm. long with thirty segments, similar in general to P_1 though much larger and stouter and tapering less rapidly; proximal segments broad, becoming about as long as broad on the tenth or twelfth and remaining so until near the tip; the second-fifth segments are strongly carinate; P_3 13 mm. long, much smaller and more slender than P_2 ; P_4 somewhat smaller than P_3 ; P_5 9 mm. long, somewhat smaller than P_4 ; the proximal carination occurs on the second-sixth segments; the following pinnules very slowly become more slender, at the same time gradually increasing in length; the distal pinnules are 10 mm. long; the distal carination of the proximal segments, which is very marked on the earlier pinnules, gradually becomes less and less marked, involving fewer and fewer segments; it is but slightly evident beyond P_{20} .

The color is a uniform purplish or violet black.

Locality.—Red Sea; the type, which is No. 1055, Berlin Museum, was collected by Hemprich and Ehrenberg.

Remarks.—The stout short-segmented cirri which do not taper distally, and the uniformly large size of P_2 , which is much larger than P_3 , at once distinguish this species from all others in the genus.

CRASPEDOMETRA MADAGASCARENSIS, new species.

Description.—Centro-dorsal thick-discoidal, the bare polar area slightly convex, 4 mm. in diameter; cirri arranged in two closely crowded irregular marginal rows.

Cirri XVI, 34–36, 25 mm. to 30 mm. long, stout basally, tapering slightly in the proximal half; first segment short, the following slowly increasing in length to the eighth or tenth, which is slightly broader than long to one-third broader than long, the distal segments being slightly shorter again; from the eleventh-fifteenth (usually about the fourteenth) onward small but prominent dorsal spines are developed; opposing spine larger than the spine on the preceding segment, triangular, the apex subterminal, arising from the whole dorsal surface of the penultimate segment, and equal in height to about one-half of its lateral diameter; terminal claw somewhat longer than the penultimate segment, moderately slender, especially in the distal two-thirds, rather strongly curved proximally but becoming straighter distally.

Radials concealed; IBr_1 very short, bandlike, in apposition laterally; IBr_2 very broadly pentagonal, twice as broad as long, the lateral edges only half as long as those of the IBr_1 ; $IIBr$ 4(3+4); IBr and $IIBr$ series and first brachials in close lateral apposition and laterally flattened; these flattened lateral edges are moderately produced; synarthrial tubercles obsolete.

Sixteen arms (in the type) 130 mm. long; first brachial slightly wedge shaped, twice as broad as long exteriorly, entirely united interiorly; second brachial about the same size, but more obliquely wedge shaped; third and fourth (syzygial pair) slightly longer interiorly than exteriorly, twice as broad as the exterior length; next three or four brachials oblong, three times as broad as long, then becoming very obliquely wedge shaped, twice as broad as long, after the proximal fourth of the arm gradually becoming less obliquely wedge shaped, but never oblong; eighth and ninth and following with slightly produced distal edges, this character gradually dying away after the middle of the arm.

P_1 slender, becoming very delicate in the distal half, 10 mm. long with twenty-six to twenty-eight segments, the first short, the following gradually increasing in length so that the eighth and following are about as long as broad; the second-fourth are rather strongly carinate.

P_1 9.5 mm. long, more slender than P_1 , with thirty-two segments, tapering more rapidly from the base and therefore more slender in its outer portion; earlier segments short, becoming about as long as broad on the twelfth and following; second-fourth segments strongly carinate, the following narrowly carinate to about the middle of the pinnule; P_2 12 mm. long, very slightly stouter basally than P_1 but tapering much more gradually, so appearing considerably stouter, with twenty-seven segments, which become about as long as broad on the sixth and from one-third to one-half again as long as broad distally; P_3 similar to P_2 , but very slightly larger and longer; P_4 8 mm. long, resembling P_2 and P_3 , but tapering more rapidly and therefore more slender in the distal half; P_5 6 mm. long, small and weak, with sixteen segments, all but the outermost broader than long; following pinnules similar, gradually increasing in length and in the length of the component segments, the distal pinnules being exceedingly slender, 8 mm. long. On the large lower pinnules the second-fifth segments are rather strongly carinate; this decreases rather rapidly distally, being soon confined to the second-fourth and then to the second-third, disappearing at the end of the proximal fourth of the arm.

The color is brownish white, the cirri being lighter and tinged with purple.

Locality.—Madagascar; the type, which is No. 5348 Berlin Museum, was collected by Doctor Voeltzkow.

Genus HETEROMETRA A. H. Clark.

HETEROMETRA SAVIGNII (J. Müller).

Comatula multiradiata AUDOUIN, in SAVIGNY, Description de l'Égypte, 1817, p. 205, pl. 1, fig. I, 1-6.—LEUCKART, Isis, vol. 5, 1839, p. 612.—VON GRAFF, Das Genus Myzostoma, 1877, pp. 2, 22; *Challenger Reports*, vol. 10, Zoology, 1884, p. 32.

Comatula, sp. LEUCKART, Zeitschr. für organ. Physik, vol. 3, 1833, Heft 4, p. 387.

Comatula adeonæ DE BLAINVILLE, Manuel d'Actinologie (1834), 1836, pl. 26, figs. 1-5 (but not p. 249).

Alecto savignii J. MÜLLER, Archiv für Naturgeschichte, 1841, Heft I, p. 144 (Red Sea).

Antedon savignyi LUDWIG, in KOSSMAN, Reise nach dem Rothen Meer, vol. 5, 1880, p. 4.—P. H. CARPENTER, *Challenger Reports*, vol. 26, Zoology, 1888, pp. 55, 252, 253, 255, 263, 366, 380.—HARTLAUB, Nova Acta Acad. German., vol. 58, 1891, No. 1, pl. 2, fig. 20.—CHADWICK, Journ. Linn. Soc. (Zool.), vol. 31, 1908, p. 47.

Heterometra savignii A. H. CLARK, Proc. Biol. Soc. Washington, vol. 22, 1909, p. 11.

Localities.—"Red Sea;" Gulf of Suez; Suez Bay; Ul Shubuk; Khor Shinab; Tor; Salaka.

This species ranges eastward as far as Muscat and Kurrachi.

Depth.—Littoral, and down to 12 fathoms.

HETEROMETRA JOUBINI, new species.

Description.—Cirri XXII, 39–43, 30 mm. long; the segments are all subequal, about half again as broad as long; those in the outer half of the cirrus bear short dorsal spines. The cirri as a whole are comparatively long and moderately stout.

Twenty arms 80 mm. long; ten IIBr 4 (3+4) series are present. The arm divisions and the arm structure are as in *H. reynaudii* of Ceylon.

P_2 is the longest, half again as long as P_1 or P_3 , slender, with 21 segments, which become squarish on the fourth or fifth, then somewhat longer than broad, and elongate terminally; P_3 is about as long as P_1 ; P_4 and the following pinnules are shorter than P_3 . The lower segments of the proximal pinnules are moderately carinate.

Compared directly with the type of *H. reynaudii*, this species is seen to differ in its longer and somewhat more slender cirri, which have slightly longer segments.

Locality.—Zanzibar; the type, which is in the Paris Museum, was collected by M. Rousseau in 1841. Dr. P. H. Carpenter examined the specimen on his visit to Paris, and noted it as representing a new species, though he never mentioned it in print.

HETEROMETRA GRAVIERI, new species.

Description.—Cirri XXVIII, 36–39, 21 mm. long, more slender than those of the preceding species; first segment short, the following gradually increasing in length to the fifth or sixth, which is from one-third to one-half again as broad as long, and after the eighth or ninth beginning to decrease again, so that those in the outer half are about twice as broad as long; the segments in the outer half of the cirri bear short dorsal spines.

Nineteen arms 80 mm. long, nine IIBr 4 (3+4) series being present; the arm structure resembles that of the preceding species; the division series have produced lateral margins; the brachials are only very slightly overlapping.

P_1 small and weak; P_2 half again as long as P_1 , slender, and flagellate distally, with 24 segments, of which the second-fifth are carinate; P_3 slightly smaller than P_2 , but much larger than P_1 ; P_4 about as large as P_1 ; following pinnules slightly shorter than P_4 ; the proximal segments of all the lower pinnules are distinctly carinate.

As a whole this species is slightly more slender and delicate than the preceding, though of the same size.

Locality.—Zanzibar; the type, which is in the Paris Museum, was collected by M. Rousseau in 1841. Dr. P. H. Carpenter also noted this species as new and as different from the preceding.

Subfamily STEPHANOMETRINÆ.

Genus STEPHANOMETRA A. H. Clark.

STEPHANOMETRA MARGINATA (P. H. Carpenter).

Antedon marginata P. H. CARPENTER, *Challenger* Reports, vol. 26, Zoology, 1888, p. 230, pl. 40.—CHADWICK, Journ. Linn. Soc. (Zool.), vol. 31, 1908, p. 45.

Stephanometra marginata A. H. CLARK, Vid. Medd. fra den naturhist. Forening i København, 1909, p. 169; Amer. Naturalist, vol. 43, p. 255.

Locality.—Suez Bay.

This species is otherwise known from Ceylon, Singapore, and the Philippine Islands.

Depth.—10 fathoms. Other records of depth range from littoral down to 30 fathoms.

Remarks.—Mr. Chadwick has expressed some doubt in regard to the correctness of his identification of his two small and imperfect specimens from Suez, and I must confess to sharing his doubts.

STEPHANOMETRA INDICA (Smith).

Comatula indica SMITH, Ann. and Mag. Nat. Hist. (4), vol. 17, 1879, p. 406; Philos. Trans. Roy. Soc., vol. 168, p. 564, pl. 51, figs. 3, 3b (but not 3a).

Stephanometra indica A. H. CLARK, Proc. Biol. Soc. Washington, vol. 22, 1909, p. 10.

Antedon palmata BELL, Trans. Linn. Soc. (Zool.), (2), vol. 13, 1909, pt. 1, p. 20.

Localities.—Rodriguez; Madagascar; Seychelles; north reef, Farquhar Atoll.

This species has also been reported from Ceylon, the Maldive Islands (under the name of *Actinometra maculata*), and the Bay of Bengal.

Depth.—Littoral, and down to 34 fathoms.

Remarks.—A specimen from Madagascar collected by M. Grandidier in 1905 has the cirri XXX, 20-22, smooth, the sixth segment the longest, about half again as long as broad; the last ten segments are half again as broad as long; the longer segments are slightly constricted centrally; there are about twenty-five arms; the IIIBr series are developed in all cases internally instead of externally, as usual in the species; P_2 is long, stiff and spinelike, with about sixteen segments. *Stephanometra indica* might aptly be described as *S. monacantha* with P_2 much elongated and more delicate and flagellate distally.

Subfamily MARIAMETRINÆ.

Genus DICHROMETRA A. H. Clark.

DICHROMETRA PROTECTUS (Lütken).

Antedon protectus LÜTKEN, Mus. Godeffroy Cat., vol. 5, 1874, p. 190 (*nomen nudum*).—LÜTKEN, in P. H. CARPENTER, Trans. Linn. Soc. (Zool.), (2) vol. 2, 1879, p. 19.

Antedon imparipinna P. H. CARPENTER, Journ. Linn. Soc. (Zool.), vol. 16, 1882, p. 502.—CHADWICK, Journ. Linn. Soc. (Zool.), vol. 31, 1908, p. 46.

Dichrometra protectus A. H. CLARK, Proc. Biol. Soc. Washington, vol. 22, 1909, p. 13; Vid. Medd. fra den naturhist. Forening i København, 1909, p. 172.

Localities.—Suez Bay; Suakim Harbor.

This species ranges eastward to Hongkong, the Philippines, Fiji, and Tonga.

DICHROMETRA PALMATA (J. Müller).

?*Caput-Medusæ cinereum* LINCK, De stellis marinis, 1733, p. 57, pl. 21, No. 33.

Comatula leucomelas (Rüppel MS.) LEUCKART, Zeitschr. für organ. Physik, vol. 3, 1833, Heft 4, pp. 387, 390 (*nomen nudum*).

Alecto palmata J. MÜLLER, Archiv für Naturgesch., 1841, Heft 1, p. 144.

Comatula scita Paris Museum MS.—DUJARDIN and HUPÉ, Hist. nat. des zoophytes; échinodermes, 1862, p. 208.

Comatula palmata VON MARTENS, in von der Decken's Reise in Ost-Africa, vol. 3, 1869, p. 129.

Antedon palmata BELL, Proc. Zool. Soc. London, 1882, pp. 533, 534.—HARTLAUB, Nova Acta Acad. German., vol. 58, 1891, No. 1, p. 49.—CHADWICK, Journ. Linn. Soc. (Zool.), vol. 31, 1908, p. 47.

Antedon leucomelas (Rüppel MS.) HARTLAUB, Nova Acta Acad. German., vol. 58, 1891, No. 1, p. 51.

Dichrometra palmata A. H. CLARK, Proc. Biol. Soc. Washington, vol. 22, 1909, p. 13.

Localities.—"Red Sea;" coral reef of Misharif Island, Khor Don-gola; between tide marks at Suez.

This species ranges eastward to the Tonga Islands.

Depth.—Littoral.

DICHROMETRA (? species).

Locality.—Cape St. André, Madagascar; Zanzibar.

Depth.—About 30 meters.

Remarks.—In the Paris Museum there are two young examples of some species of *Dichrometra* from Madagascar. One specimen has exactly twenty arms, one IIIBr series being present and one IIBr series absent; the other also has about twenty arms. The species represented is related to *D. palmata*, though apparently different. There is a similar specimen in the British Museum from Zanzibar.

DICHROMETRA (? species).

Locality.—Zanzibar.

Remarks.—The British Museum contains a young specimen of some species of *Dichrometra*, near *D. flagellata*, from Zanzibar.

DICHROMETRA KLUNZINGERI (Hartlaub).

Antedon klunzingeri HARTLAUB, Nachr. Ges. Göttingen, Mai 1890, p. 175; Nova Acta Acad. German., vol. 58, 1891, No. 1, p. 46, pl. 2, figs. 22, 25.

Dichrometra klunzingeri A. H. CLARK, Proc. Biol. Soc. Washington, vol. 22, 1909, p. 13.

Locality.—Koseir; Ras-el-Millan, Red Sea.

Depth.—Littoral.

DICHROMETRA FLAGELLATA (J. Müller).

Alecto flagellata J. MÜLLER, Archiv für Naturgesch., 1841, Heft 1, p. 145.

Antedon flagellata LUDWIG, Senck. naturforsch. Ges., vol. 21, 1899, Heft 4, p. 538.

Dichrometra flagellata A. H. CLARK, Proc. Biol. Soc. Washington, vol. 22, 1909, p. 13.

Localities.—Reef opposite the harbor of Lamu; Zanzibar.

Depth.—Littoral.

This species ranges eastward to Singapore, New Guinea, and Amboina.

Family COLOBOMETRIDÆ.

Genus CENOMETRA A. H. Clark.

CENOMETRA EMENDATRIX (Bell).

Antedon emendatrix BELL, Ann. and Mag. Nat. Hist., (6) vol. 9, 1892, p. 428, pl. 18.

Antedon spicata BELL, Trans. Linn. Soc. (Zool.), (2), vol. 13, 1909, pt. 1, p. 20.

Description.—Centrodorsal low hemispherical or thick discoidal, the sides strongly inclined, about 4 mm. in diameter; dorsal pole very slightly concave, small; cirrus sockets arranged in two crowded and irregular rows.

Cirri XVIII, 28–33 (usually nearer the latter), comparatively slender, 15 mm. to 20 mm. long; first cirrus segment short, the following gradually increasing in length to the fourth which, with the following, is about half again as broad as long; the penultimate and antepenultimate segments are about as long as broad; after the eighth the distal dorsal edge begins to project slightly, this projection after the sixteenth becoming a pair of small, though prominent, dorsal spines situated close together, one on either side of the median line; on the antepenultimate segment only a single median small spine is found; in the terminal third of the cirrus the paired dorsal spines, which at first were near the distal dorsal edge of the segments, have moved to a median position; opposing spine long and prominent, reaching somewhat over half the diameter of the penultimate segment in height, arising from nearly or quite the entire dorsal surface of that segment, the apex subterminal or median; terminal claw about as long as the penultimate segment, rather stout basally, but abruptly decurved and comparatively slender in its distal half.

Radials four or five times as broad as long, their interior angles slightly separated; IBr_1 oblong, twice as broad as long; IBr_2 (axillary) nearly or quite as long as broad, pentagonal, with a slight transverse median constriction; $IIBr_2$, resembling the IBr ; the division series and first brachials bear comparatively short, though thick, ventrolateral processes; the division series are well separated.

Seventeen arms 90 mm. long, comparatively slender and delicate, increasing slightly in width to the twelfth or fourteenth brachials, then gradually tapering distally; first two brachials subequal, wedge-shaped, about twice as broad as long exteriorly, the first interiorly

united for about the proximal two-thirds; third and fourth brachials (syzygial pair) slightly longer than broad to slightly broader than long; following three to five or six brachials oblong, about twice as broad as long, then becoming very obliquely wedge-shaped, almost triangular, half again as broad as long, and in the distal part of the arm nearly or quite as broad as long; there is a slight development of small spines along the distal edges of the brachials. Syzygies occur between the third and fourth brachials, again between the twenty-first and twenty-second to thirtieth and thirty-first, and distally at intervals of from nine to twenty-five (usually about fourteen) oblique muscular articulations.

P₁ small, slender, and weak, 5 mm. or 6 mm. long, with 18 or 20 segments, of which the second, third, and fourth bear broad carinate processes; first four segments broader than long, the fifth about as long as broad, the following slightly longer than broad, becoming about half again as long as broad distally; P₂ stout and stiff, 9 mm. long, with fifteen to eighteen segments, and much the largest pinnule on the arm, though not nearly so stout as in most of the allied species; the first two or three segments are broader than long, the following about as long as broad, distally slightly longer than broad; the distal ends of the segments are slightly produced and finely spinous, especially in the outer part; following pinnules small and weak, 4 mm. long, with eleven segments, the first two broader than long, the third about as long as broad, the following slowly increasing in length, becoming half again as long as broad distally; distal pinnules very slender, 9 mm. long, with twenty segments, which become twice as long as broad or somewhat longer distally.

The color is purple, the cirri and P₂ yellow, the remaining pinnules white.

Localities.—Mauritius; Seychelles.

Depth.—Littoral, and down to 39 fathoms.

Remarks.—This redescription is based upon a fine specimen in the Berlin Museum. The whole animal is very slender, which, with the strong carination of the lower pinnules, makes this species an easy one to recognize.

A fine series of eight specimens, four from Mauritius (the types) and four from the Seychelles (*Sea Lark* expedition) show that the arms vary from twelve to twenty-two in number, though the former is only found in young examples; the usual number appears to be between fifteen and twenty. The arm division is always external as in the other species of *Cenometra*. The arms are from 90 mm. to 100 mm. long. The cirri are XIV–XX, 32–41 (usually about 35); P₂ is, for the genus, comparatively slender, and possesses from nineteen to twenty-one segments. The strong carination of the earlier segments of the proximal pinnules make this species an easy one to recognize.

Genus COLOBOMETRA A. H. Clark.

COLOBOMETRA CHADWICKI, new species.

Antedon scrripinna CHADWICK, Journ. Linn. Soc. (Zool.), vol. 31, 1908, p. 44 (Suez Bay).

? *Oligometra scrripinna* A. H. CLARK, Amer. Naturalist, vol. 43, 1909, p. 255.

Description.—Centrodorsal thin discoidal, the polar area broad and flat, 2 mm. in diameter; cirrus sockets arranged in a single closely crowded marginal row.

Cirri XVI, 22–24, 12 mm. to 14 mm. long; first segment short, the following gradually increasing in length to the third or fourth which, with the remainder, is about as long as broad; second and following segments with the distal dorsal edge produced into a finely spinous transverse ridge which gradually becomes crescentic, in dorsal view, then V-shaped, on the tenth segment parting in the middle and on the last four or five before the antepenultimate becoming a pair of small erect median spines; antepenultimate segment with a single median spine; the dorsal processes are rather high, reaching about one-quarter of the lateral diameter of the segments; opposing spine large and prominent, triangular, terminal, arising from the whole dorsal surface of the penultimate segment, and one-half as high as that segment; terminal claw slightly longer than the penultimate segment, stout, strongly curved basally, but becoming straighter distally; the distal ventral edge of the cirrus segments is slightly produced and very finely spinous.

Radials even with the edge of the centrodorsal; IBr_1 oblong, slightly over twice as broad as long, not in contact basally; IBr_2 long, pentagonal, about as long as broad, the lateral edges nearly or quite as long as those of the IBr_1 .

Ten arms about 90 mm. long; first two brachials subequal, slightly wedge-shaped, the first about twice as broad as the median length, interiorly united for its proximal half or two-thirds, the distal halves of the inner edge diverging at a right angle; the second is somewhat longer; third and fourth (syzygial pair) about as long as broad; following five or six approximately oblong, about twice as broad as long, then becoming triangular, as long as broad, and distally wedge-shaped, about as long as broad, longer than broad terminally; IBr series and brachials in the proximal fourth of the arm with a faint narrow median keel; proximal triangular brachials with slightly produced distal ends.

P_a absent; P_1 7.5 mm. to 8 mm. long, very slender, evenly tapering from the base to the tip with sixteen segments, the first broader than long, the second about as long as broad, the following gradually increasing in length, after the seventh being three times as long as broad; the outer segments have slightly spinous distal ends; P_2

13 mm. long, slender (though stouter than P_1), especially distally, with twenty or twenty-one segments, the first not quite so long as broad, the second slightly longer than broad, the following increasing in length, so that the fourth and following are between two and five times as long as broad; fourth or fifth and following segments with the distal edge and the distal ventro-lateral border prominently everted and spinous as in the other species of the genus, though the production is not quite so much as usual; the dorsal (outer) portion of the outer edge of the segments is not produced; P_3 7.5 mm. long, as slender as P_1 but stiffened, with fifteen segments resembling those of P_2 ; P_4 6.5 mm. long, with sixteen segments, resembling P_3 , though slightly more slender; P_5 6 mm. long, slightly more slender and less stiffened than P_4 , but with the same number of segments; following pinnules resembling P_5 , soon slowly increasing in length, slenderness, and length of the component segments.

The color is deep violet, with the cirri a purplish flesh color.

Locality.—Suez Bay; the type is Cat. No. 27509, U.S.N.M.

Depth.—10 fathoms.

Genus DECAMETRA A. H. Clark.

DECAMETRA MÖBIUSI, new species.

Description.—Centrodorsal small, thin-discoidal; cirrus sockets arranged in a single, somewhat irregular, marginal row.

Cirri XIV, 14–16, 7 mm. long; first segment short, the following gradually increasing in length to the sixth, which, with the following, is about as long as broad; on the fourth a slight projection of the distal dorsal edge begins to appear; this moves progressively anteriorly, on the ninth and following becoming a low, short transverse median ridge, appearing as a small spine in lateral view, and on the last two or three segments a small median spine; opposing spine median in position, slender and sharp, much longer than the processes on the preceding segments, in height equal to about half the diameter of the penultimate segment; opposing spine longer than the penultimate segment, stout and comparatively slightly curved basally, but becoming more slender and more strongly curved in the distal half.

Radials projecting slightly beyond the centro-dorsal, the distal interrarial angles widely separated; IBr_1 oblong, about two and one-half times as broad as long; IBr_2 (axillary) broadly pentagonal, about twice as broad as long.

Ten arms 50 mm. long, resembling those of *C. studeri*.

P_1 4.5 mm. long, slender, evenly tapering, and becoming flagellate distally with about thirteen segments, the first short, the second and third about as long as broad, the following gradually increasing in length, becoming about twice as long as broad distally, but shorter

again terminally; P_2 5 mm. long, stouter and stiffer than P_1 (the largest pinnule on the arm), with eleven or twelve segments; first segment about twice as broad as long, second almost or quite as long as broad, the following gradually increasing in length, being twice as long as broad in the distal half of the pinnule; the distal edges of the second and following pinnule segments are slightly everted and finely spinous, and the dorsal distal angles of the segments are produced in the form of a short blunt process tipped with a tuft of fine spines; P_3 3 mm. long, with about twelve segments proportioned as in P_2 ; the pinnule is slightly less stout basally than P_1 , and is shorter, weaker, and more slender than that pinnule; following pinnules similar, soon gradually increasing in length and becoming more slender, the distal pinnules being about 6 mm. long with about eighteen much elongated segments, and exceedingly slender.

The color is light yellowish, the primibrachs, a narrow band at the level of the second syzygy, and a few ill-defined bands in the distal portion of the arms, purple; perisome brown; cirri and P_2 straw yellow.

Locality.—Mauritius; the type, which is in the Berlin Museum, was collected by Prof. K. Möbius.

DECAMETRA MODICA, new species.

Description.—Centrodorsal small, discoidal, with a very small dorsal pole; cirrus sockets arranged in two closely crowded irregular rows.

Cirri XIV–XVI, 16–20, 8 mm. long; first segment short, the following slowly increasing in length and becoming terminally about as long as broad; third and following with slightly produced distal dorsal edges which gradually become narrower and move to a more central position, on the last five or six segments preceding the penultimate becoming a very small sharp median spine; opposing spine prominent, sharp, slender, subterminal, directed obliquely forward, much larger than the spines on the preceding segments, in height equal to one-half the lateral diameter of the penultimate segment.

Radials short, about two and one-half times as broad as long; IBr_1 oblong, rather more than twice as broad as long; IBr_2 pentagonal, broader than long, the distal edges slightly thickened.

Ten arms 35 mm. to 40 mm. long, resembling those of *D. informis*, but the brachials are slightly longer.

P_1 3.5 mm. long, with eleven or twelve segments, the first short, the second about as long as broad, the following slowly increasing in length and becoming three times as long as broad terminally; the pinnule is comparatively stout and resembles P_2 , though, in direct proportion to its lesser length, smaller; P_2 4.5 mm. long with thirteen segments, the first short, the second about as long as broad, the following gradually increasing in length and becoming twice as long as broad distally; third and following segments with slightly projecting

and finely spinous distal edges, especially along the thin ventral distal border; P_3 3 mm. long, much smaller and weaker and much less stiff than P_1 , with ten segments; following pinnules similar, slowly becoming longer and more slender, the component segments slowly increasing in length; distal pinnules very slender, 5 mm. long.

The color is light pinkish narrowly and sparsely banded with deep purple, or entirely deep purple.

Locality.—Bagamoyo, German East Africa.

DECAMETRA ALAUDÆ, new species.

Description.—Cirri XV, 26, small and slender, all the segments subequal, about twice as broad as long.

Ten arms, 90 mm. long resembling those of *D. taprobanes*, to which this species appears to be most closely related.

P_a absent; P_1 slender and flagellate, 8 mm. long with 21 squarish segments; P_2 much larger, stouter, and stiffer, 11 mm. long, tapering very gradually, with 16 segments, the fifth-seventh half again as long as broad, the remainder squarish or broader than long; from the fourth outward the segments have projecting distal edges and distal angles so that the pinnule as a whole reminds one strongly of P_2 in the genus *Cenometra*; P_3 is similar to P_2 but smaller and much more slender and flagellate distally, 10 mm. long, with 19 segments; P_4 and the following pinnules are 6 mm. long, small, weak, and slender; the distal pinnules are very slender, 10 mm. long.

Locality.—Cargados Carajos; the type, which is in the British Museum, was collected by Prof. J. Stanley Gardiner on the *Sea Lark* expedition. Another specimen from the same locality is probably referable to this species, though P_2 is more slender.

Depth.—30 fathoms.

Genus OLIGOMETRA A. H. Clark.

OLIGOMETRA SERRIPINNA, var. OCCIDENTALIS, new variety.

Antedon serripinna P. H. CARPENTER, Notes from the Leyden Museum, vol. 3, 1881, p. 182.—HARTLAUB, Nova Acta Acad. German., vol. 58, 1891, No. 1, p. 82, pl. 5, fig. 48.

Oligometra serripinna A. H. CLARK, Proc. Biol. Soc. Washington, vol. 21, 1908, p. 126.

Locality.—Mauritius; Cargados Carajos.

Depth.—Littoral, and down to 30 fathoms.

Remarks.—The single specimen before me from Mauritius has the arms about 55 mm. long and the cirri XVI, 17, 9 mm. long. P_2 is 7 mm. long, with about fifteen segments.

The lower pinnules of this specimen exhibit almost none of the peculiar expansion of the distal ends of the segments from which this species gets its name, there being merely a small process ending in a

tuft of very fine spines at the three distal angles. This character, however, is very variable, and I find that I can match this specimen fairly well with some from Singapore in the collection of the Copenhagen Museum and with those from India in the collection of the Indian Museum. The cirri are proportionately slightly longer than usual, but here again it agrees with other specimens from India and Singapore. In these two features it represents rather an extreme type, and it may be that additional material will show the existence on Mauritius of a peculiar species, a localized offshoot from the *O. serripinna* stock.

Nine specimens in Prof. J. Stanley Gardiner's collection from Cargados Carajos which I recently examined at the British Museum are similar to the preceding. The cirri are XIV–XVII, 18–22 (usually 19–20), the distal segments being about as long as broad. P_2 is much larger than P_1 or P_3 and has nineteen segments, most of which are about as long as broad, or slightly longer than broad. The lateral processes at the distal ends of the outer pinnule segments are only slightly evident; the segments of the pinnules succeeding P_2 have rather strongly projecting distal edges and angles. The arms are from 70 mm. to 80 mm. long.

For the present it would be convenient to distinguish this form as var. *occidentalis*.

Family TROPIOMETRIDÆ.

Genus TROPIOMETRA A. H. Clark.

TROPIOMETRA CARINATA (Lamarck).

?*Alecto carinata* LEACH, Zool. Misc., vol. 2, 1815, p. 63.

Comatula carinata LAMARCK, Hist. nat. des animaux sans vertèbres, vol. 2, 1816, p. 535.—MICHELIN, Revue et mag. de zool., 1845, p. 27.—VON MARTENS, in von der Decken's Reise in Ost-Africa, vol. 3, 1869, p. 129.—POURTALES, Bull. Mus. Comp. Zool., vol. 5, 1878, No. 9, p. 214.

Comatula bicolor DUJARDIN and HUPÉ, Hist. nat. des zoophytes; échinodermes, 1862, p. 208.

Actinometra solaris VON MARTENS, von der Decken's Reise in Ost-Africa, vol. 3, 1869, p. 129.

Antedon carinata (part) P. H. CARPENTER, Challenger Reports, vol. 26, Zoology, 1888, p. 199 (but not pl. 34).

Antedon capensis BELL, Marine Investigations in South Africa, vol. 4, 1905, p. 139, pl. 2.

Tropiometra carinata A. H. CLARK, Smiths. Misc. Coll. (Quarterly Issue), vol. 50, 1907, pt. 3, p. 349.

Localities.—Seychelles; Mascarine Islands; Zanzibar; Mauritius; Madagascar; Saya de Malha;¹ Cargados Carajos; north reef, Farquhar Atoll; the following localities in South Africa: off Algoa Bay, close

¹ This locality is given by Bell as "Sd M. 300-500;" the solution of this missing word puzzle as given in the key is "Saya de Malha, 55 fathoms." What is the significance of the "300-500?"

to Riy Bank (lat. $33^{\circ} 58' S.$; long. $25^{\circ} 51' 30'' E.$); Tugela River mouth bearing NW. by W., $3\frac{1}{2}$ miles distant; Rocky Bank, False Bay; Dumford Point bearing NE by E., 9 miles distant.

Depth.—Littoral, and down to 30 fathoms.

Bottom.—Reefs; rocks; rocks and coral; sand and shell; dark sand, black specks, and rocks.

TROPIOMETRA PICTA (Gay).

?*Alecto carinata* LEACH, Zool. Misc., vol. 2, 1815, p. 63.

Comatula picta GAY, Historia física y política de Chile, vol. 8, 1854, p. 429.—

DUJARDIN and HUPÉ, Hist. nat. des zoophytes; échinodermes, 1862, p. 208.

Antedon braziliensis (LÜTKEN MS.) VERRILL, Trans. Conn. Acad. Sci., vol. 1, 1867, p. 341 (*nomen nudum*).—RATHBUN, Trans. Conn. Acad. Sci., vol. 5, 1879, p. 156.

Antedon carinata (part) P. H. CARPENTER, *Challenger Reports*, vol. 26, Zoology, 1888, p. 199, pl. 34, figs. 1-7.

Antedon dübeni (part) P. H. CARPENTER, *Challenger Reports*, vol. 26, Zoology, 1888, p. 181, pl. 37, fig. 1 (but not figs. 2, 3).

Tropiometra braziliensis A. H. CLARK, Smiths. Misc. Coll. (Quarterly Issue), vol. 50, pt. 3, 1907, p. 349.

Locality.—St. Helena.

Remarks.—The specimen obtained by the *Challenger* at Bahia in 20 fathoms and referred by Carpenter to Böhlische's *Antedon dübeni* is also of this species.

Gay has described, under the name of *Comatula picta*, a new species of *Tropiometra* from Chile. I have examined his specimens in Paris and find that they are of the common Brazilian species. He says:

C. radiis incrassatis, pinnatis decem, dorso obsoletè carinatis et tuberculatis; cirrhis dorsalibus 24; brachiis in pinnulis rubro et fusco articulatis.

Especie de radios espesos, articulados, en número de diez, cargados de pínulas bastante delgadas; estos radios llevan en el medio de su faz dorsal una carena poco marcada, sobre la cual existe una sene de tuberculillos salientes y puntuados. Los brazos ó las cirras dorsales son delgados, articulados, desiguales y en número de veinte y cuatro. Toda la extension del brazo y de las cirras dorsales está como articulada por manchas anulares, alternativamente encarnadinas y pardas.

Esta linda especie de Comátula es hasta cierto punto vecina del *C. carinata* Lamk. Sus brazos ó radios son espesos y carnudos como en esta especie, pero difiere de ella por su coloracion sumamente elegante, que consiste en manchas anulares de un bruno encarnadino el cual cubre toda la estension de los radios y de las pínulas. Se halla en Chile.

Gay's original specimens are in the Paris Museum, and were in 1862 listed by Dujardin and Hupé in their monograph under the name of *Comatula picta*. This name was originally proposed by Valenciennes, and subsequently adopted by Gay. Gay did not find the species in Chile himself, but merely recorded in his work some specimens he found in the Paris Museum labeled as from Chile while he was engaged in writing his history. The coast of Chile has been carefully searched by zoölogists over and over again, and no one who has been in that country ever mentioned the occurrence of crinoids

(other than *Heliometra*) there from personal observation. Dr. Carlos Porter, of Santiago, assures me that they are never found there. We must conclude, therefore, either that Valenciennes' specimens were wrongly labeled, or that some other Chile is meant.

The *Antedon braziliensis* proposed, but not described, by Lütken, which is the same thing as Gay's *Comatula picta*, and subsequently compared in considerable detail, with Lamarck's *Comatula carinata* by Rathbun has never been recognized; it is a perfectly good species, however, as I have recently been able to assure myself, most obviously differing from *carinata* in the greater length of the outer cirrus segments.

TROPIOMETRA ENCRINUS, new species.

Comatula, sp. AUDOUIN, in SAVIGNY, Description de l'Egypte, 1817, p. 205, pl. 1.
Alecto encrinus LÜTKEN MS.

? *Antedon*, sp. MOSELEY, Quart. Journ. Micr. Sci., vol. 17, 1877, p. 8.—MAC MUNN, Quart. Journ. Micr. Sci., vol. 30, 1890, p. 55.

Antedon marmorata P. H. CARPENTER, Challenger Reports, vol. 26, Zoology, 1888, p. 202 (*nomen nudum*).

Antedon carinata (part) (not of Lamarck) P. H. CARPENTER, Challenger Reports, vol. 26, Zoology, 1888, p. 199.

Localities.—"Red Sea;" Aden; ? Suez.

This species ranges eastward to the South Sea Islands and the east coast of Asia; it appears to be generally rare, though common about Ceylon.

Remarks.—I am not absolutely certain that the Red Sea specimens of *Tropiometra* should be referred to this species, as I have never been able to examine any of large size, but they seem to be nearer *encrinus* of corresponding size than to any other form.

Tropiometra encrinus, while having the same number of cirrus segments as *T. carinata* and *T. picta*, has proportionately longer and stouter cirri, the stoutness being especially noticeable distally. Owing to the increased size of the cirri as a whole, the proportions of the segments are the same as in *T. picta*.

Family THALASSOMETRIDÆ.

Subfamily THALASSOMETINÆ.

Genus CROTALOMETRA A. H. Clark.

CROTALOMETRA MAGNICIRRA (Bell).

Antedon magnicirra BELL, Marine Investigations in South Africa, vol. 4, 1905 p. 141, pl. 4.

Crotalometra magnicirra A. H. CLARK, Proc. Biol. Soc. Washington, vol. 22, 1909, p. 80.

Localities.—Buffalo River, East London, bearing NW. $\frac{1}{2}$ W., 19 miles distant; the same landmark bearing N. 15 miles distant; East London bearing NW. $\frac{1}{2}$ N., approximately 20 miles distant (Bell).

Depth.—300–450 fathoms.

CROTALOMETRA PORRECTA (P. H. Carpenter).

Antedon porrecta P. H. CARPENTER, *Challenger Reports*, vol. 26, Zoology, 1888, p. 250, pl. 52, figs. 3-5.

Antedon (Crotalometra) porrecta KÆHLER and VANEY, *Bull. du mus. d'hist. nat.*, 1910, No. 1, p. 32.

Locality.—Near Ascension Island (lat. $7^{\circ} 54' 20''$ S.; long. $14^{\circ} 28' 20''$ W.).

Depth.—420 fathoms.

Bottom.—Volcanic sand.

Remarks.—MM. Kæhler and Vaney record this species from the Bay of Biscay (lat. $45^{\circ} 19'$ N.; long. $6^{\circ} 29'$ W.) in 1,480 meters; it thus probably occurs on the coast of Morocco.

CROTALOMETRA FLAVA (Kæhler).

Antedon flava KÆHLER, *Rev. biol. du nord de la France*, vol. 7, 1895, p. 475.

Antedon (Crotalometra) flava KÆHLER and VANEY, *Bull. du mus. d'hist. nat.*, 1910, No. 1, p. 31.

Locality.—South of the Canary Islands (lat. $25^{\circ} 39'$ N.; long. $18^{\circ} 22'$ W.).

Depth.—882 meters.

This species was, previous to 1910, only known from the Bay of Biscay, where the type was dredged by the *Caudan* in 1,480 meters.

Genus THALASSOMETRA A. H. Clark.

THALASSOMETRA LUSITANICA (P. H. Carpenter).

Antedon lusitanica P. H. CARPENTER, *Proc. Roy. Soc. Edinburgh*, vol. 12, 1884, p. 368; *Challenger Reports*, vol. 26, Zoology, 1888, p. 109, pl. 39, figs. 1-3; *Journ. Linn. Soc. (Zool.)*, vol. 24, 1892, p. 65.—KÆHLER, *Échinodermes provenant des campagnes du yacht Princesse-Alice*, 1909, p. 267, pl. 1, figs. 7, 8; pl. 32, figs. 12-14.

Thalassometra lusitanica A. H. CLARK, *Smiths. Misc. Coll. (Quarterly Issue)*, Issue, vol. 50, 1907, pt. 3, p. 360.

Antedon (Crotalometra) lusitanica KÆHLER and VANEY, *Bull. du mus. d'hist. nat.*, 1910, No. 1, p. 31.

Localities.—Madeira; from the Brazilian cable, near Funchal; south of Funchal (lat. $32^{\circ} 39' 20''$ N.; long. $16^{\circ} 40' 55''$ W.; lat. $32^{\circ} 32' 30''$ N.; long. $17^{\circ} 02'$ W.; and lat. $32^{\circ} 34'$ N.; long. $17^{\circ} 02' 45''$ W.); off the southeast coast of Teneriffe, Canary Islands (lat. $28^{\circ} 04'$ N.; long. $16^{\circ} 49' 30''$ W.); near Mogador, Morocco (lat. $31^{\circ} 43' 30''$ N.; long. $10^{\circ} 46' 45''$ W.); between Madeira and Morocco (lat. $33^{\circ} 17'$ N.; long. $11^{\circ} 23'$ W.).

Depth.—900-2,165 meters.

THALASSOMETRA OMISSA (Kæhler).

Antedon omissa KÆHLER, *Échinodermes provenant des campagnes du yacht Princesse-Alice*, 1909, p. 268, pl. 33, fig. 10.

Locality.—Off the southeastern coast of Teneriffe, Canary Islands.

Depth.—1,330-1,349 meters.

THALASSOMETRA MULTISPINA (P. H. Carpenter).

Antedon multispina P. H. CARPENTER, *Challenger Reports*, vol. 26, Zoology, 1888, pp. 117, 241, 248, pl. 13, figs. 1-3; pl. 14, figs. 5-7; pl. 69, figs. 1-4.

Thalassometra multispina A. H. CLARK, *Smiths. Misc. Coll. (Quarterly Issue)*, vol. 50, 1907, p. 360.

Locality.—Near Ascension Island (lat. $7^{\circ} 54' 20''$ S.; long. $14^{\circ} 28' 20''$ W.).

Depth.—420 fathoms.

Bottom.—Volcanic sand.

COSMIOMETRA GARDINERI, new species.

Description.—This species is most closely related to *C. woodmasoni*, with the type of which I was able to compare it directly. The cirri are longer and more slender than in that form, 30 mm. long with 29-31 segments which are proportionately longer.

Twenty arms; the carination of the division series is broader than in *woodmasoni*; the lower brachials have a broad median keel quite different from the faintly indicated crest of *woodmasoni*; the outer brachials are very strongly overlapping and broadly carinate, the raised portion, when viewed dorsally, having a triangular shape, the apex of the triangle being proximal. The same type of carination is found in *woodmasoni*, but the triangles are narrower.

Locality.—Saya de Malha; the type, which is in the British Museum, was collected by the *Sea Lark* expedition under Prof. J. Stanley Gardiner.

Depth.—135 fathoms.

Subfamily CHARITOMETRINÆ.

Genus PACHYLOMETRA A. H. Clark.

PACHYLOMETRA SCLATERI (Bell).

Antedon sclateri BELL, *Marine Investigations in South Africa*, vol. 4, 1905, p. 140, pl. 3.

Pachylometra sclateri A. H. CLARK, *Proc. Biol. Soc. Washington*, vol. 22, 1909, p. 20.

Locality.—East London bearing NW. $\frac{1}{2}$ N., 18 miles distant.

Depth.—250-300 fathoms.

Suborder MACROPHREATA.

Family ANTEDONIDÆ.

Subfamily ANTEDONINÆ.

Genus ANTEDON de Fréminville.

ANTEDON BIFIDA (Pennant).

Δεκάκνεμος rosacea LINCK, *De stellis marinis*, 1733, p. 55, pl. 37, fig. 66 (based upon the *Decempeda cornubiensium* of Llhuyd, 1699).

Asterias bifida PENNANT, British Zoology, vol. 4, 1777, No. 70.

Antedon rosacea P. H. CARPENTER, Zool. Anzeiger, Jahrg. 4, 1881, p. 521; *Challenger* Reports, vol. 26, Zoology, 1888, pp. 355, 377.—J. BARROIS, Rev. biol. du nord de la France, vol. 1, 1889, pp. 32, 33.

Antedon bifida BELL, Ann. and Mag. Nat. Hist., (6) vol. 4, 1889, p. 432.

Locality.—Azores (common); Bay of San Pedro (abundant); Algiers; Tangier; Morocco; Madeira.

Remarks.—There are three specimens of this species in the Copenhagen Museum collection which were collected at Tangier; one of them has the arms about 60 mm. long, rather stout, and cirri XXXV, 13–15 (usually 15) about 12 mm. long; P_1 is 12 mm. long with twenty-five segments, and P_2 5 mm. long with sixteen segments; the production of the distal ends of the segments of the proximal pinnules is marked; another is similar, with arms 60 mm. long and cirri XXX, 14–16; it has eleven arms, one of the IBr axillaries (the right posterior) bearing on the right (i. e., anterior) side a single axillary; the third specimen is similar to these, but smaller, with arms only 40 mm. long.

In general structure and in the details of the arms, especially the arm bases and the IBr series, these animals appear to be identical with a series at hand from southern England and the Channel Islands; moreover, there are the same small clusters of perisomic interradials in each interradial angle. A specimen from Plymouth, England, so far as I can see, matches them exactly in all respects.

It was somewhat of a surprise to me to find this species at Tangier, south of the Straits of Gibraltar, instead of the quite different *A. mediterranea*. It is more surprising still to find an example with eleven arms showing a physiological similarity as well as a similarity in form between specimens from England and from Africa; for of the four species of *Antedon*, *A. bifida* is the only one which, so far as known, ever exhibits any tendency toward an increase in the number of the arms over the primitive ten.

But the most curious fact of all is that it is this species and not *A. mediterranea* which occurs at Algiers. I have recently examined five specimens and several pentacrinoids from that locality which are in the Paris Museum. They resemble closely those from Tangier just described, but the cirri are XXIV–XXX, 12–14 (usually 13–14).

Carpenter has recorded "*Antedon rosacea*" from Madeira. While his specimens probably are of the present species, there is a possibility that they are in reality *Antedon hupferi*.

ANTEDON MEDITERRANEA (Lamarck).

Δεκάκνεμος crocea LINCK, De stellis marinis, 1733, p. 53 (based upon the *δεκάδασνακτενοειδής* of Columna, 1592).

Δεκάκνεμος barbata LINCK, De stellis marinis, 1733, p. 55, pl. 37, fig. 64 (based upon the *Δεκάκνεμος fimbriata* of Barrelier, 1714).

Comatula mediterranea LAMARCK, Hist. nat. des animaux sans vertèbres, vol. 2, 1816, p. 535.

Antedon rosacea (part) P. H. CARPENTER, Journ. Linn. Soc. (Zool.), vol. 13, 1877, p. 441; Zool. Anzeiger, Jahrg. 4, 1881, p. 521; *Challenger* Reports, vol. 26, Zoology, 1888, pp. 355, 377.

Antedon mediterranea A. H. CLARK, Vid. Medd. fra den naturhist. Forening i København, 1909, pp. 120, 128.

Locality.—Bay of Benzert (Bizerta), Tunis.

Depth.—50–100 fathoms.

Remarks.—It is not absolutely certain that this is the species represented by the specimens dredged by the *Porcupine* off the coast of Tunis, though it seems most probable that this determination is correct. There is a possibility that *A. adriatica*, *A. bifida*, or even an undescribed form may occur in these waters. *A. mediterranea* is found on the European side of the Mediterranean as far east as the Cyclades, from which islands I have seen a specimen in the Bergen Museum.

ANTEDON HUPFERI (Hartlaub).

Antedon rosacea GREEFF, Zool. Anzeiger, Jahrg. 5, 1882, pp. 116, 159.

Antedon hupferi HARTLAUB, Nachr. Ges. Göttingen, Mai, 1890, p. 171; Nova Acta Acad. German., vol. 58, 1891, No. 1, p. 88, pl. 5, figs. 53, 59.

Locality.—Isla das Rolas (near São Thomé); Wapoo, Ivory Coast; Gorée, Sénégal; Canary Islands; Madeira.

Depth.—13–21 fathoms.

Remarks.—The *Challenger* specimen of "*Antedon dubenii*" described and figured by Carpenter is an example of *Tropiometra picta*. He unhesitatingly identified with "*Antedon dubenii*" as he understood it the specimens secured at Rolas by Professor Greeff, and some others from Madeira which he obtained from Professor Lovén and from Mr. J. Y. Johnson of Funchal; at the same time he expresses the belief that this species is only a synonym of *Antedon bifida*.

In view of all this it is rather uncertain just what the Canary and Madeira specimens can be; they are "unquestionably identical with those from Brazil," but the latter represent two species. Taking everything together, however, it would seem that the species with which he intended to compare these specimens was the one described by Böhlische, or else he certainly could not have remarked on their similarity to *Antedon bifida*.

Genus IRIDOMETRA A. H. Clark.

IRIDOMETRA MAURITIANA, new species.

Description.—Centrodorsal low-hemispherical, the slightly concave dorsal pole 1 mm. in diameter; cirrus sockets arranged in approximately four closely crowded alternating rows, the most proximal with about four cirrus sockets to each radial area.

Cirri XXX–XLV, 10–13 (usually 11–12) 9 mm. to 11 mm. long; first segment short, second not quite so long as broad, third twice as long as broad, fourth about two and one-half times as long as the proximal diameter; following segments gradually decreasing in length so that the penultimate is less than one-third again as long as broad; the elongated lower segments are slightly constricted centrally, and the distal half of the cirrus is rather strongly flattened laterally; opposing spine prominent, though small, sharp, sub-terminal, more or less erect; terminal claw slightly longer than the penultimate segment, rather stout and rather strongly curved.

Radials even with the edge of the centrodorsal; IBr_1 exceedingly short and bandlike; IBr_2 triangular, twice as broad as long, the anterior angle sharp, the middle of the posterior margin somewhat produced proximally, the lateral angles extending considerably beyond the anterolateral angles of the IBr_1 .

Ten arms 30 mm. to 45 mm. long; first brachial very short, somewhat shorter interiorly than exteriorly, interiorly united basally; second brachial much larger, irregularly quadrate; third and fourth brachials (syzygial pair) somewhat longer interiorly than exteriorly, about twice as broad as the interior length; following four brachials approximately oblong, about three times as broad as long, then soon becoming triangular, about as long as broad, and in the outer part of the arm wedge shaped and longer than broad.

Syzygies occur between the third and fourth brachials, again between the ninth and tenth and fourteenth and fifteenth, and distally at intervals of three oblique muscular articulations.

P_1 small and slender, but somewhat stiffened, tapering evenly and rather rapidly, 3.5 mm. long with twelve segments, most of which are considerably elongated; P_2 similar, but somewhat smaller and more slender, 2.7 mm. long with eleven segments; P_3 6 mm. to 7 mm. long with eighteen to twenty segments, slender and flagellate; P_4 4 mm. long with thirteen segments, shorter than those of P_3 ; following pinnules slowly increasing in length, the distal pinnules being 6 mm. to 7 mm. long and exceedingly slender.

Locality.—Mauritius; the type, which is No. 5349 (part) Berlin Museum, was collected by Professor Möbius.

Madagascar; a specimen in the Paris Museum was collected here by M. Grandidier in 1905.

Remarks.—This species is most nearly related to *I. nana* of the East Indies, but may at once be distinguished by its much stouter cirri, the component segments of which are much less constricted centrally, and by the larger P_{11} , which is considerably stiffened.

I had been aware of the occurrence of some species of this genus on Mauritius for some time before I was able to examine any speci-

mens, and in reviewing Mr. Chadwick's paper upon the Red Sea crinoids I mentioned that the *I. nana* group of species occurred there, for three years ago, while at Cambridge, I had been permitted to look over the letters sent by Capt. Nicholas Pike to Prof. Louis Agassiz while the former was United States consul at Mauritius. In one of these letters Captain Pike, in his usual charming style, describes a little crinoid which he found on the reef near Port Louis (about 1867), but which broke all up so that he could not preserve it. However he made a color sketch of it, and this I was able to recognize as being of a species near *I. nana*.

IRIDOMETRA ÆGYPTICA, new species.

Antedon parvicirra CHADWICK, Journ. Linn. Soc. (Zool.), vol. 31, 1908, p. 45.

?*Iridometra parvicirra* A. H. CLARK, Amer. Naturalist, vol. 43, 1909, p. 255.

Description.—Cirri XXV, 14–16 (usually 15–16), 13 mm. long, comparatively stout; first segment short, second about as long as broad, fourth or fifth the longest, about two and one-half times the median diameter; following segments slowly decreasing in length so that the antepenultimate is about one third longer than broad. The longer proximal segments are constricted centrally, with enlarged distal ends; there are no dorsal spines or projections. The cirri are rather strongly constricted laterally. The opposing spine is prominent, terminal, and directed obliquely forward.

Ten arms, apparently about 40 mm. long, resembling those of *I. nana*.

P_1 short, evenly tapering, about 5 mm. long, with eight segments which become twice as long as broad distally; P_2 considerably larger and much longer, but evenly tapering and very slender distally, 9.5 mm. long, with twelve segments which become much elongated outwardly; P_3 larger than P_2 , much the largest pinnule on the arm, 13 mm. long, becoming very slender distally, with eighteen to twenty segments, the distal much elongated, three times as long as broad; the ends of the segments are slightly swollen, but there are no spinous projecting borders; P_4 small and weak, 4.5 mm. to 5 mm. long, the outer segments much elongated and with somewhat swollen ends; P_5 slightly longer; following pinnules similar, becoming more slender and increasing in length distally.

Localities.—Suez Bay; Gulf of Suez.

Depth.—10 fathoms (one record).

Remarks.—This new species is very readily distinguishable from *Iridometra parvicirra* by its very much larger cirri, though the pinnulation is not very different.

Subfamily PEROMETRINÆ.

Genus PEROMETRA A. H. Clark.

PEROMETRA AFRA, new species.

Description.—Centrodorsal rounded-conical, the dorsal pole papillose, resembling closely the centrodorsal of *P. diomedæ* of Japan.

Articular radial faces almost exactly as in *P. diomedæ*; relation of radials to centrodorsal as in *P. diomedæ*.

Cirri long and slender, resembling those of *P. diomedæ*, 25 mm. to 30 mm. long, decreasing somewhat in length toward the dorsal pole, with 44–52 segments.

Eleven to fourteen arms 50 mm. long; the proximal arm structure, the flattening of the rays, and the synarthrial tubercles are exactly as in *P. diomedæ*, except that the synarthrial tubercles are not so long, being more like those of *P. pusilla*; the IIBr series are 2.

The lower pinnules are exceedingly slender, with greatly elongated segments; P_3 is the longest, followed by P_2 , P_1 , and P_4 ; P_5 and the following pinnules are short.

The color is purple, the cirri lighter.

Locality.—Providence Island, northeast of Madagascar; the type, which is in the British Museum, was collected by the *Sea Lark* expedition under Prof. J. Stanley Gardiner.

Depth.—125 fathoms.

Subfamily ZENOMETRINÆ.

Genus LEPTOMETRA A. H. Clark.

LEPTOMETRA CELTICA (Barrett and McAndrew).

Comatula woodwardii BARRETT, Ann. and Mag. Nat. Hist., (2) vol. 19, 1857, p. 33, pl. 7, fig. 1 (not of Forbes, 1852).

Comatula celtica BARRETT and McANDREW, Ann. and Mag. Nat. Hist. (2), vol. 20, 1858, p. 44.

Antedon mediterraneus (part) WYVILLE THOMSON, Proc. Roy. Soc. Edinburgh, vol. 7, 1872, p. 765.

Antedon phalangium (not of Müller) P. H. CARPENTER, Zool. Anzeiger, Jahrg. 4, 1881, p. 521 (part); Proc. Roy. Soc. Edinburgh, vol. 12, 1884, p. 361 (part);

Challenger Reports, vol. 26, Zoology, 1888, p. 159 (part); Journ. Linn. Soc. (Zool.), vol. 24, 1892, p. 67.

Leptometra celtica A. H. CLARK, Proc. Biol. Soc. Washington, vol. 21, 1908, p. 129.

Antedon (Leptometra) phalangium KÖHLER and VANEY, Bull. du mus. d'hist. nat., 1910, No. 1, p. 32.

Localities.—Seine Bank (between Madeira and Morocco); near the Seine Bank (lat. $33^{\circ} 47' N.$, long. $14^{\circ} 21' W.$); near the Gorringe Bank (west of the Straits of Gibraltar) (lat. $36^{\circ} 30' 30'' N.$; long. $11^{\circ} 36' 15'' W.$; and lat. $36^{\circ} 31' N.$; long. $11^{\circ} 32' W.$); off Madeira; Funchal Bay, Madeira; south of Cape St. Vincent (lat. $36^{\circ} 20' N.$;

long. $9^{\circ} 01' W.$); south of the Canary Islands (lat. $26^{\circ} 17' N.$; long. $17^{\circ} 12' W.$).

This species occurs northward to the Faroe Islands.

Depth.—50–500 (?700) fathoms.

Remarks.—As Carpenter, in discussing the specimen from Funchal Bay, speaks of “the extreme shortness of the later cirrus joints,” which is the character by which *Leptometra celtica* is most readily separated from *L. phalangium*, it has seemed best to refer the records for the Atlantic coast of Africa and the outlying islands to the former species. The specimens from off Cadiz and from off the Portuguese coast, which I have recently examined, are undoubtedly this form.

Professor Kœhler remarks that this species ranges westward across the Atlantic, as Carpenter received specimens from Brazil, from a cable picked up in between 915 and 1,280 meters; the specimens upon which this statement was based were found on the Brazilian cable, but at its Madeira end, near Funchal.

LEPTOMETRA PHALANGIUM (J. Müller).

Alecto phalangium J. MÜLLER, Archiv für Naturgeschichte, 1841, Heft 1, p. 142.

Antedon mediterraneus (part) WYVILLE THOMSON, Proc. Roy. Soc. Edinburgh, vol. 7, 1872, p. 765.

Antedon phalangium MARION, Ann. de sci. nat., sér. 6, vol. 8, 1879, p. 40, pl. 18.—P. H. CARPENTER, Zool. Anzeiger, Jahrg. 4, 1881, p. 521 (part); Proc. Roy. Soc. Edinburgh, vol. 12, 1884, p. 361 (part); *Challenger* Reports, vol. 26, Zoology, 1888, p. 159 (part).

Leptometra phalangium A. H. CLARK, Proc. Biol. Soc. Washington, vol. 21, 1908, p. 129.

Localities.—Tunis; Bay of Benzert (Bizerta), Tunis; Skerki Bank, off Tunis.

This species occurs also along the French and Italian coasts of the Mediterranean.

Depth.—30–120 fathoms.

Family PENTAMETROCRINIDÆ.

Genus PENTAMETROCRINUS A. H. Clark.

PENTAMETROCRINUS ATLANTICUS (Perrier).

Eudiocrinus atlanticus PERRIER, Comptes rendus, vol. 96, 1883, p. 725.—Kœhler, Échinodermes provenant des campagnes du yacht *Princesse-Alice*, 1909, p. 271, pl. 32, figs. 15–18.

Pentametrocrinus atlanticus A. H. CLARK, Proc. Biol. Soc. Washington, vol. 21, 1908, p. 135.

Eudiocrinus (*Pentametrocrinus*) *atlanticus* Kœhler and VANEY, Bull. du mus. d'hist. nat., 1910, No. 1, p. 31.

Localities.—Azores; southeast of Terceira (lat. $38^{\circ} 26' N.$; long. $26^{\circ} 30' 45'' W.$); Canary Islands; southeast of Arreceife (lat. $29^{\circ} 06' 30'' N.$; long. $13^{\circ} 02' 45'' W.$); between Madeira and Mogador (lat. $32^{\circ} 27' N.$; long. $12^{\circ} 15' W.$).

This species ranges northward to the Gulf of Gascony, and I have examined a specimen, apparently of this form, from Martinique, French West Indies.

Depth.—578–1,165 meters.

Specimens are recorded from as deep as 1,674 meters.

II. STALKED CRINOIDS.

Family PENTACRINITIDÆ.

Genus ENDOXOCRINUS A. H. Clark.

ENDOXOCRINUS WYVILLETHOMSONI (Wyville Thomson).

Pentacrinus wyville-thomsoni JEFFRIES, Proc. Roy. Soc., vol. 19, 1870, p. 157 (*nomen nudum*); Report Brit. Ass. for 1870, 1871, p. 119 (*nomen nudum*).—WYVILLE THOMSON, Proc. Roy. Soc. Edinburgh, vol. 7, 1872, p. 767.—P. H. CARPENTER, *Challenger Reports*, vol. 11, Zoology, 1884, p. 313, pl. 17, figs. 2–6; pl. 18; pl. 24; pl. 57, fig. 1.—FILHOL, *La vie au fond des mers*, 1885, pl. 2, opposite p. 10; pl. 5 (colored), opposite p. 160; p. 210; p. 212; fig. 66, I, p. 211.—PERRIER, *Nouv. arch. du mus. d'hist. nat.* (2), vol. 9, 1886, p. 145; *Explorations sous-marines*, 1886, p. 272.—P. H. CARPENTER, *Journ. Linn. Soc. (Zool.)*, vol. 24, 1892, p. 64.—ALBERT, PRINCE DE MONACO, *Comptes rendus*, vol. 126, 1899, p. 313.—RICHARD, *Les campagnes scientifiques de S. A. S. le Prince de Monaco*, 1900, p. 78.—RICHARD, *Bull. soc. zool. France*, vol. 27, 1902, p. 84.—ALBERT, PRINCE DE MONACO, *Comptes rendus*, vol. 134, 1902, p. 963; vol. 140, 1905, p. 1373; *Bull. mus. Monaco*, 1905, No. 39, p. 1.—RICHARD, *Bull. mus. Monaco*, No. 41, 1905, p. 3.—KÖHLER, *Échinodermes provenant des campagnes du yacht, Princesse-Alice*, 1909, p. 254, pl. 5, fig. 1 (colored).

Pentacrinus PARFAIT, *Rapport sur la campagne scientifique du Talisman en 1883*, 1884, p. 41.

Pentacrinus PARFAIT, *Rapport sur la campagne scientifique du Talisman en 1883*, 1884, pp. 41, 47.—DE FOLIN, *Sous les mers*, 1887, pp. 275, 276, 288.

Endoxocrinus wyvillethomsoni A. H. CLARK, *Proc. Biol. Soc. Washington*, vol. 21, 1908, p. 152.

Pentacrinus (Endoxocrinus) wyville-thomsoni KÖHLER and VANEY, *Bull. du mus. d'hist. nat.*, 1910, No. 1, p. 31.

Localities.—Off the west coast of Morocco; off the coast of Morocco (lat. 32° 40' N.; long. 12° 10' E.; lat. 32° 31' N.; long. 12° 08' E.); off Cape Cantin, Morocco; Azores; Madeira, near Funchal and off Porto Santo Bay (lat. 32° 39' 20'' N.; long. 16° 40' 55'' W.); east of Hierro, Canaries (lat. 27° 41' N.; long. 17° 53' 45'' W.); off the southeast coast of Teneriffe, Canaries (lat. 28° 04' N.; long. 16° 49' 30'' W.); Canary Islands; between the Canary and Cape Verde islands; south of the Canary Islands (lat. 25° 39' N.; long. 18° 26' W.); between Madeira and Mogador (lat. 32° 31' N.; long. 12° 09' W.).

This species is found as far north as Rochefort (lat. 45° 59' 30'' N.).¹

Depth.—1,330–1,917 meters.

¹ Bell has recorded it from Ferne Islands, off the coast of Northumberland. Probably he meant to say "Fayal," as it certainly does not occur anywhere in the British Channel. A similar error in his citation of the habitat of *Antedon dübenii* is "Bengal" instead of Brazil.

The extreme depth known for the species is 1,095 fathoms, at which depth it was originally dredged by the *Porcupine*.

Family HYOCRINIDÆ.

Genus GEPHYROCRINUS Kœhler and Bather.

GEPHYROCRINUS GRIMALDII Kœhler and Bather.

Hyocrinus ALBERT, PRINCE DE MONACO, Comptes rendus, vol. 134, 1902, p. 963.—RICHARD, Bull. soc. zool. France, vol. 27, p. 84.

Gephyrocrinus grimaldii, KÆHLER and BATHER, Mém. soc. zool. France, vol. 15, 1902, p. 68.—ALBERT, PRINCE DE MONACO, Comptes rendus, vol. 142, 1906, p. 621.—KÆHLER, Échinodermes provenant des campagnes du yacht *Princesse-Alice*, 1909, p. 256, pl. 1, fig. 12; pl. 32, figs. 1-9.

Localities.—East of Hierro, Canaries (lat. $27^{\circ} 41' N.$; long. $17^{\circ} 53' 45'' W.$); south of Funchal, Madeira (lat. $32^{\circ} 32' 30'' N.$; long. $17^{\circ} 02' W.$).

Depth.—1,786-1,968 meters.

Family BOURGUETICRINIDÆ.

Genus BATHYCRINUS Wyville Thomson.

BATHYCRINUS ALDRICHIANUS Wyville Thomson.

Bathycrinus aldrichianus WYVILLE THOMSON, The Atlantic, vol. 2, 1877, pp. 92-95 (86-87), fig. 23; Journ. Linn. Soc. (Zool.), vol. 13 (1876), 1878, pp. 47-51, fig. 1.—A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, pp. 553, 554.

Bathycrinus campbellianus P. H. CARPENTER, Challenger Reports, vol. 11, Zoology, 1884, p. 238, pl. 7a, figs. 22, 23; pl. 8; fig. 15, p. 239.

Locality.—Lat. $1^{\circ} 47' N.$; long. $24^{\circ} 26' W.$

Depth.—1,850 fathoms.

BATHYCRINUS GRACILIS Wyville Thomson.

Bathycrinus gracilis WYVILLE THOMSON, Proc. Roy. Soc. Edinburgh, vol. 7, 1872, p. 772.—KÆHLER, Échinodermes provenant des campagnes du yacht *Princesse-Alice*, 1909, p. 254.

Locality.—Between the Azores and Gibraltar (lat. $38^{\circ} 54' 55'' N.$; long. $21^{\circ} 06' 45''$ — $18^{\circ} 45'' W.$).

This species is otherwise only known from the Bay of Biscay.

Depth.—5,005 meters.

The previous record of depth is 2,435 fathoms.

BATHYCRINUS PERRIERI Kœhler and Vaney.

Bathycrinus perrieri KÆHLER and VANEY, Bull. du mus. d'hist. nat., 1910, No. 1, p. 26, figs. 1, 2, p. 27.

Locality.—Off Cape Ghir, Morocco (lat. $30^{\circ} 03' N.$; long. $14^{\circ} 02' E.$).

Depth.—2,212 meters.

BATHYCRINUS RECUPERATUS (E. Perrier).

Ilyocrinus recuperatus E. PERRIER, Rev. scient., vol. 35, 30 mai 1885, p. 691.—
P. H. CARPENTER, Ann. and Mag. Nat. Hist. (5), vol. 16, p. 108.

Ilyocrinus recuperatus E. PERRIER, Rev. scient., vol. 35, 30 mai, 1885, p. 691.—
P. H. CARPENTER, Ann. and Mag. Nat. Hist. (5), vol. 16, p. 108.

Ilyocrinus recuperatus E. PERRIER, Explorations sous-marines, 1886, p. 273, fig. 193; p. 341, fig. 242, No. 4.

Bathycrinus recuperatus HAMANN, Bronn's Klassen und Ordnungen des Tier-Reichs, 1907, p. 1574.—KÖHLER and VANEY, Bull. du mus. d'hist. nat., 1910, No. 1, p. 28, fig. 3, p. 29.

Locality.—Northeast of the Azores (lat. $44^{\circ} 20' N.$; long. $19^{\circ} 31' W.$)

Depth.—4,255 meters.

Genus RHIZOCRINUS M. Sars.

RHIZOCRINUS PARFAITI (Perrier).

Democrinus parfaiti PERRIER, Comptes rendus, vol. 96, 1883, No. 7, p. 450.

Rhizocrinus parfaiti A. H. CLARK, Proc. U. S. Nat. Mus., vol. 36, 1909, p. 676.

Locality.—Off the coast of Morocco "par le travers du cap Blanc."

Depth.—1,900 meters.

Remarks.—This is a perfectly good species, but Carpenter subjected it to such severe criticism in the *Challenger* report that it has been allowed to drop into oblivion.

RHIZOCRINUS CHUNI Döderlein.

Rhizocrinus sp. nov. DÖDERLEIN, in CHUN, Aus den Tiefen des Weltmeeres, 1900, p. 487, fig., p. 488.

Rhizocrinus chuni DÖDERLEIN, Die gestielten Crinoiden der *Siboga*-Expedition, 1907, p. 14, pl. 1, fig. 5; pl. 6, fig. 6; fig. 6, p. 14.

Locality.—Off Somaliland, East Africa.

Depth.—1,644–1,668 meters.

UNIDENTIFIABLE SPECIES.

ANTEDON IMPINNATA (P. H. Carpenter).

Antedon impinnata VON GRAFF, *Challenger* Reports, vol. 10, Zoology, 1884, pp. 15, 16, 18 (*nomen nudum*).—P. H. CARPENTER, *Challenger* Reports, vol. 26, Zoology, 1888, p. 206.

Remarks.—The very short description of this species reads: "The third, fourth, and fifth brachials have no pinnules; eight or ten cirri of twelve joints," which would be now expressed: P_a , P_2 , and P_b absent; cirri VIII–X, 12. Carpenter further says that this "is a little species, which was obtained at Mauritius by Professor Möbius, who was kind enough to show it to me when I visited Kiel."

The type is recorded as having been taken in North Bay, Mauritius, at a depth of 15 fathoms.

COMATULES.

Comatules FERUSSAC, Bull. des sci. nat. (2), vol. 26, 1831, p. 183.

Ferussac records that M. Lamare-Picquot brought home numerous comatulids from his voyage to the East Indies and South Africa.

COMATULA.

Comatula VON GRAFF, *Challenger* Reports, vol. 10, Zoology, 1884, p. 48; repeated in BRAUN, Centralbl. für Bakteriöl. und Parasitenkunde, vol. 3, 1888, p. 186.

Professor von Graff records myzostomes from an undetermined comatulid taken at Fouquet Island, southeast of Mauritius, in 18 fathoms.

COMATULES.

Comatules PARFAIT, Rapport sur la campagne scientifique du *Talisman* en 1883, 1884, pp. 39, 41, 43, 45, 47, 49, 55, and 57.

Captain Parfait records comatulids from the *Talisman* dredgings as follows: south of the Bay of Cadiz (lat. $36^{\circ} 02' N.$; long. $9^{\circ} 01' E.$), 126 meters ("une pleine baille de comatules"); off Cape Spartel (lat. $35^{\circ} 26' N.$; long. $9^{\circ} 09' E.$), 717 meters; lat. $33^{\circ} 47' N.$; long. $11^{\circ} 23' E.$, 1,635 meters ("comatules jaune soufre;" probably *Thalassometridæ*); lat. $32^{\circ} 27' N.$; long. $12^{\circ} 15' E.$, 1,123 meters; lat. $30^{\circ} 08' N.$; long. $14^{\circ} 02' E.$, 2,200 meters; lat. $30^{\circ} 03' N.$; long. $14^{\circ} 02' E.$, 2,212 meters; lat. $29^{\circ} 01' N.$; long. $14^{\circ} 51' E.$, 1,180 meters; lat. $28^{\circ} 37' N.$; long. $15^{\circ} 22' E.$, 865 meters; lat. $28^{\circ} 35' N.$; long. $15^{\circ} 30' E.$, 975 meters; lat. $28^{\circ} 35' N.$; long. $15^{\circ} 36' E.$, 1,238 meters; lat. $26^{\circ} 17' N.$; long. $17^{\circ} 11' E.$, 355 meters ("multitude de comatules"); lat. $26^{\circ} 16' N.$; long. $17^{\circ} 11' E.$, 250 meters; lat. $26^{\circ} 13' N.$; long. $17^{\circ} 10' E.$, 175 meters; lat. $26^{\circ} 07' N.$; long. $17^{\circ} 08' E.$, 130 meters; lat. $25^{\circ} 41' N.$; long. $18^{\circ} 16' E.$, 410 meters; lat. $21^{\circ} 51' N.$; long. $19^{\circ} 18' E.$, 235 meters; lat. $19^{\circ} 19' N.$; long. $20^{\circ} 22' E.$, 2,333 meters; lat. $19^{\circ} 16' N.$; long. $20^{\circ} 20' E.$, 2,320 meters; lat. $38^{\circ} 38' N.$; long. $30^{\circ} 41' E.$, 1,257 meters; lat. $45^{\circ} 59' N.$; long. $6^{\circ} 29' E.$, 1,480 meters.

COMATULES.

Comatules DE FOLIN, Sous les mers, 1887, pp. 266, 277, 280, 281, 282, 283, 288, 297, 328, and 335.

Marquis de Folin records unidentified comatulids from the west coast of Morocco, off Cape Spartel, 717 meters; west coast of Morocco, 1,123 meters; west coast of Morocco, 2,200 meters; west coast of Morocco, 2,212 meters; Canary Islands, 1,180 meters, 865 meters, 1,238 meters, 345 meters, 130 meters, and 410 meters; off the coast of Senegal, 2,333–2,320 meters; among the Azores, 1,257–1,255 meters (and in the Gulf of Gascony, 1,480 meters).

Probably these specimens are in the Paris Museum.

COMATULES.

Comatules RICHARD, Les campagnes scientifiques de S. A. S. le Prince Albert I^{er} de Monaco, 1900, p. 78.

Professor Richard says: "Enfin il est interessant de signaler la capture, dans une masse, d'une centaine de comatules, par 175 meters sur le banc de Gorringe."

PENTAMETROCRINUS (? species).

Endiocrinus sp. nov. CHUN, Aus den Tiefen des Weltmeeres, 1900, p. 488.

Professor Chun records the discovery by the *Valdivia* of a sulphur yellow "*Eudiocrinus*" representing a new species (as determined by Professor Döderlein) in 1,289 meters off the coast of Somaliland.

BATHYCRINUS.

Bathycrinus MILNE-EDWARDS, Comptes rendus, vol. 97, 1883, p. 1392.

One or more species of this genus are stated to have been dredged "par le travers du cap Ghir et du cap Noun, à 120 milles environ de la côte," at depths between 2,000 and 2,300 meters.

One of these is undoubtedly the *Bathycrinus perrieri* recently described by MM. Kœhler and Vaney.

BATHYCRINUS.

Bathycrinus FILHOL, La nature, No. 572, 17 mai 1884, p. 391.

This refers to the same specimens as does the preceding.

CRINOÏDE.

Crinoïde PARFAIT, Rapport sur la campagne scientifique du *Talisman* en 1883, 1884, p. 43.

Captain Parfait here records a small crinoid from lat. 30° 03' N.; long. 14° 02' E., in 2,212 meters, on gray mud and broken shell; it is undoubtedly the same as the preceding.

BATHYCRINUS.

Bathycrinus PARFAIT, Rapport sur la campagne scientifique du *Talisman* en 1883, 1884, pp. 43, 57.

The remains of *Bathycrinus* are here recorded from lat. 29° 52' N.; long. 14° 04' E., in 2,075 meters, on gray mud and broken shell; and from lat. 44° 20' N.; long. 19° 31' E., in 4,255 meters, on soft white mud.

BATHYCRINUS.

Bathycrinus E. PERRIER, Rev. scient., vol. 35, 30 mai 1885, p. 691.

MM. Kœhler and Vaney believe that the individual here referred to is the specimen described by them as *Bathycrinus perrieri*.

CRINOÏDE.

Crinoïde DE FOLIN, Sous les mers, 1887, p. 281.

De Folin here records a small stalked crinoid from 2,212 meters off the west coast of Morocco.

BATHYCRINUS.

Bathycrinus DE FOLIN, Sous les mers, 1887, p. 282.

De Folin records a specimen dredged from 2,083 meters off the west coast of Morocco.

UN PETIT CRINOÏDE.

Un petit crinoïde RICHARD, Bull. soc. zool. France, vol. 27, 1902, p. 85.

Professor Richard records a small crinoid, probably a *Bathycrinus*, from 3,890 meters in the Cape Verde Islands.

RHIZOCRINUS LOFFOTENSIS Wyville Thomson.

Rhizocrinus loffotensis WYVILLE THOMSON, The Depths of the Sea, 1873, p. 450.

Sir Wyville Thomson records that the Swedish frigate *Josephine* obtained this species on the Josephine Bank. Undoubtedly the identification is incorrect.

RHIZOCRINUS (? species).

Rhizocrinus rawsoni (not of Pourtalès) P. H. CARPENTER, *Challenger* Reports, vol. 11, Zoology, 1884, p. 262 (part), pl. 10, figs. 8-14.—KÆHLER, Échinodermes provenant des campagnes du yacht *Princesse-Alice*, p. 255.—KÆHLER and VANÉY, Bull. du mus. d'hist. nat., 1910, No. 1, p. 31.

Localities.—South of Terceira, Azores (lat. $38^{\circ} 11' N.$; long. $27^{\circ} 09' W.$); off the eastern end of Pico, Azores (lat. $38^{\circ} 20' N.$; long. $28^{\circ} 04' 25'' W.$); “par le travers du cap Ghir [Ras Aferni] et du cap Noun [Morocco], à 120 milles environ de la côte;” “par le travers du cap Blanc” (Morocco); near Cape Blanco (lat. $33^{\circ} 09' N.$; long. $11^{\circ} 58' W.$); northwest of Mogador (lat. $32^{\circ} 38' N.$; long. $12^{\circ} 09' W.$).

This group of species extends northward to west of the Scilly Islands and slightly west of south of the southwestern corner of Ireland (lat. $50^{\circ} 01' N.$; long. $12^{\circ} 26' W.$).

Depth.—1,435-2,300 meters.

The extreme recorded depth is 1,207 fathoms.

Remarks.—A number of distinct species are included by Carpenter and by Kæhler under the name *Rhizocrinus rawsoni*, none of which are the same as the West Indian form originally described under that name by Pourtalès.

DEMOCRINUS.

Democrinus PARFAIT, Rapport sur la campagne scientifique du *Talisman* en 1883, 1884, pp. 41, 43, 47.

Captain Parfait records undetermined *Rhizocrinus* from the coast of Morocco as follows: lat. $32^{\circ} 40'$ N.; long. $12^{\circ} 10'$ E., 1,435 meters; lat. $29^{\circ} 52'$ N.; long. $14^{\circ} 04'$ E., 2,075 meters; lat. $25^{\circ} 01'$ N.; long. $19^{\circ} 15'$ E., 2,638 meters.

Probably the specimens mentioned are in the Paris Museum.

DEMOCRINUS.

Democrinus DE FOLIN, Sous les mers, 1887, pp. 282, 288.

M. de Folin records *Rhizocrinus* from African waters as follows: off the west coast of Morocco, 2,083 meters; off the Canary Islands, 2,636 meters.

Probably the specimens are in the Paris Museum.

APPENDIX.

While at the British Museum recently I was, thanks to the kindness of Prof. F. Jeffrey Bell, able to examine some very interesting comatulids which had been collected by the cable repair ship *Electra* in the Red Sea, and to the northwest of Sokotra. These I find to be as follows:

Locality.—Red Sea, southeast of Messawa (lat. $15^{\circ} 02' 30''$ N.; long. $41^{\circ} 13' 30''$ E.); depth, 20 fathoms.

Oligometra scrripinna var. *electræ* A. H. Clark.

Locality.—Northwest of Sokotra (lat. $14^{\circ} 20'$ N.; long. $52^{\circ} 30'$ E.); depth, 1,200 fathoms.

Thalassometra (new species). *Thaumatometra* (new species).

Pachylometra (new species). *Cyclometra flavescens* A. H. Clark.